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RAILROAD PASS EVALUATION NEVADA-UTAH SITING AREA.(U)

NOV 79

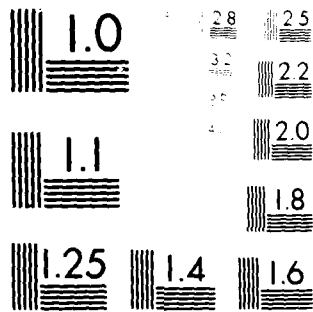
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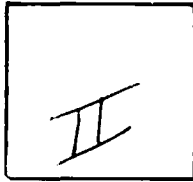


Microcopy Resolution Test Chart
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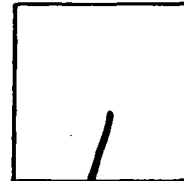
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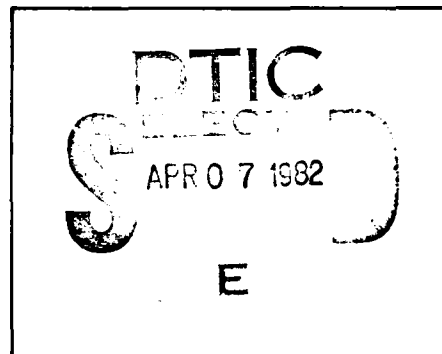
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RAILROAD PASS EVALUATION
NEVADA-UTAH SITING AREA

Prepared for:
U.S. Department of the Air Force
Ballistic Missile Office
Norton Air Force Base, California 92409

Prepared by:
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16 November 1979

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 SCOPE	2
3.0 EVALUATION CRITERIA	3
3.1 Geotechnical Evaluation	3
3.2 Railroad Engineering	4
3.3 Topographic Conditions	4
3.4 Operational Considerations	5
4.0 RESULTS	8
4.1 Railroad Pass Results	8
4.2 Existing Railroad Lines	13
5.0 RECOMMENDATIONS	15
5.1 Railroad Route Recommendations	15
5.2 Future Studies	18
APPENDIX RAILROAD PASS EVALUATION SUMMARY	

LIST OF FIGURES

1. Location Map	6
2. Schematic of Proposed Primary and Feeder Railroad Routes	16

LIST OF TABLE

1. Proposed Primary Route Passes	17
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LIST OF PHOTOS

1. Sidehill Pass, Nevada -- Evaluation Ranking I	10
2. Gandy, Nevada -- Evaluation Ranking III	11
3. Marjum Pass, Utah -- Evaluation Ranking V	12

LIST OF DRAWINGS

1. Railroad Pass Location	In Pocket
2. Proposed Primary and Feeder Railroad Routes	In Pocket

1.0 INTRODUCTION

This report presents the results of a preliminary railroad study performed by Fugro National, Inc. for the MX project in the Nevada-Utah siting area. In order to provide a "verifiable" MX system, it is proposed to construct a railroad system which will be used to move missiles from the assembly area to the clusters in the deployment area. This rail system may also be used to move personnel from the operating base (or bases) throughout the deployment area.

The geotechnically suitable deployment area generally consists of north-south trending valleys in the Basin and Range province of west-central Utah and central Nevada. Thus, identifying negotiable mountain passes between these valleys becomes the key to developing a feasible interconnecting MX railroad system.

The objectives of this preliminary study have been to:

- o identify and rank potential passes in the Nevada-Utah siting area;
- o recommend primary and feeder railroad routes into geotechnically suitable area;
- o identify potential railroad construction problems; and
- o to provide recommendations for future studies.

The study has been performed in a period of six weeks. A total of 100 passes have been identified on a map at a scale of 1:500,000 and each pass has been ranked. A second map shows proposed primary and feeder railroad routes in the deployment area. Tables are included with the report which provide pertinent information which was used in the ranking of the passes.

2.0 SCOPE

Potentially negotiable railroad mountain passes were identified and evaluated by a team consisting of a consulting railroad construction engineer, an engineering geologist, a geographer, and a geotechnical engineer. Site conditions of most passes were visually observed during low-level aerial reconnaissance from a fixed-wing aircraft (Cessna P210). Ground reconnaissance was limited to several short trips in the Ely, Nevada vicinity to inspect existing railroad trackage. After the reconnaissance, potential railroad alignments through each pass were sketched on available topographic maps, either U.S. Geological Survey 7.5', 15', or 2° sheets and the alignments were evaluated. Geotechnical evaluations were aided by review of available geologic literature, geologic maps and stereo pairs of color aerial photographs (1:25,000 scale). Following the reconnaissance and office evaluations, passes were assigned a preliminary ranking as potential railroad routes.

This study was limited to evaluating the relative suitability of mountain passes as potential railroad routes using subjective engineering and geotechnical criteria. The study was conducted without benefit of large-scale topographic maps and makes no attempt to determine specific alignments, road bed and drainage structure design, and construction cost estimates. Proposed railroad routes in the study area are presented as approximate minimum distance connections between passes without considering missile cluster locations, competing land usage, drainage conditions, or terrain conditions adverse to railroad construction.

3.0 EVALUATION CRITERIA

In order to evaluate the mountain passes for railroad alignment the following factors were considered:

- o Geotechnical;
- o Railroad Engineering;
- o Topographic; and
- o Operational.

These are discussed briefly in the following paragraphs.

3.1 Geotechnical Evaluation

The geotechnical evaluation focussed on those aspects of foundation engineering and engineering geology most critical to the route feasibility, the relative ease or difficulty of route development and route performance after construction. For this reconnaissance study the geotechnical evaluations were only directed at the most basic issues in each category. The criteria were developed based on Fugro National's experience in the Nevada-Utah study area and a research of available data. These criteria and data were then compared against field conditions observed during the aerial reconnaissance without confirmation from the ground. In each case, the general geotechnical criteria were subjectively judged individually and collectively using various scales ranging from insignificant (i.e. Normal development, few anticipated problems) to very significant (i.e. special efforts, mitigating measures, expensive development). No attempt was made to quantify any results because of the limited information, the nature of the reconnaissance, and the time limits of the study.

3.2 Railroad Engineering

The railroad consultant on this study did evaluate maximum permissible railroad grades using existing information about loads and capabilities of large horsepower diesel-electric locomotives. It was concluded that climbing grades of five or six percent would be possible but that lower grades may be required for descending grades to provide adequate braking unless the trailing cars with braking power were used. For this study, a maximum grade of four percent was determined to be an upper acceptable limit. When more detailed studies are completed and actual loading conditions are known, a grade steeper than four percent may be possible.

The alignment criteria are based on a maximum curvature of ten degrees (574 foot radius). This maximum is based on the long three-axle trucks of the locomotive and the load car which could have difficulty in negotiating sharper curves on a continuous basis unless the track is exceptionally well maintained. The allowable speed on this maximum curve, with 3 inches of super-elevation, is 20 miles per hour at equilibrium and 25 MPH speed would be compatible with the maximum grade limitation.

3.3 Topographic Conditions

To aid in describing and evaluating the individual passes, topographic maps were evaluated in order to estimate the maximum percent grade, the length of the pass, the elevation at the summit, and the pass orientation. The maps used were the U.S. Geological Survey 7 1/2' (1:24,000), 15' (1:62,500), and 2° (1:250,000) series topographic maps. Data developed from

20 series maps are not considered to be very accurate since the contour interval ranges from 100 to 200 feet.

3.4 Operational Considerations

Primary usage of the MX railroad will be for missile deployment from the assembly area to deployment valleys and periodic return for maintenance. Thus, the system must interconnect the total deployment area with the main and satellite bases. Secondary usages may include: transport of operational personnel and supplies between bases and the deployment valleys and transport of materials and personnel during construction of the operating base and shelters.

To satisfy these operational objectives and minimize transit time, a direct rather than circuitous route is preferred, except where extreme construction problems and long time delays would be experienced in route construction through difficult passes. The most desirable MX railroad system would provide a direct primary east-west route bisecting the geotechnically suitable area and connecting with the Union Pacific Railroad on the east side of the siting area, probably in the vicinity of Delta, Utah (Figure 1). Feeder routes extending north and south through relatively flat terrain would link this primary route to all potential deployment valleys. A north-south route connecting Caliente and Ely, Nevada would provide junctions with existing Nevada railroad lines near potential base areas (Figure 1).

In addition, operational requirements dictate that the MX railroad be a discrete system not used by commercial railway

lines. However, railroad connections from the proposed base locations to the existing railroads are to be constructed to allow transfer of missile components, supplies, and personnel. These conditions can be satisfied by MX rail terminals along the Union Pacific Railroad between Delta and Lund, Utah and near Panaca, Nevada. Also, an MX railroad terminal in Steptoe Valley near Ely, Nevada would provide a connection to the Nevada Northern Railroad.

4.0 RESULTS

4.1 Railroad Pass Ranking

The data developed from the geotechnical, railroad engineering and geographic evaluations has been compiled and presented in Table A-1, Railroad Pass Evaluation Summary (Appendix A). The passes are alphabetically listed along with their locations. Topographic data (i.e. maximum grade, summit elevation, and pass length/orientation) and geotechnical/engineering considerations (i.e. constrictions, flood potential, drainage crossings and excavations) are presented. The geotechnical considerations in Table A-1 have been synthesized from a number of more specific criteria judgements. For example, the category "Excavations" incorporates opinions on foundation materials (types, hardness, quantities of excavation, performance characteristics) even though the general heading does not specify all these. In addition, a number of geotechnical hazards such as slope stability, seismic, subsidence, and erosion/deposition were also considered (in a cursory fashion) and only included under "Remarks" if important enough to impact feasibility.

The overall evaluation of each pass was given a numerical ranking ranging from I (easy) to V (avoid if possible). Details of the ranking are as follows:

<u>RANKING</u>	<u>CATEGORY</u>	<u>DESCRIPTION</u>
I	Easy	Minor alignment, grade and drainage problems; light to moderate grading, rapid construction.
II	Moderate	Some alignment, grade and drainage problems; moderate to heavy grading rapid construction.
III	Difficult	One or more major alignment, grading or drainage problems; heavy grading; some deep cuts or fills; construction time: three months.
IV	Very Difficult	Several severe alignment, grading or drainage problems; heavy grading requiring deep cuts or fills over much of alignment; possible slope instability; construction time: six months.
V	Avoid if Possible	Alignment or grade unacceptable without excessively deep, long cuts and fills, long tressles or tunnels; major slope stability problems; construction time: six to 12 or more months.

In addition, cultural/environmental data applicable to each pass have been included in the "Remarks" column of Table A-1. These data pertain to:

- o Highways and utilities;
- o Land ownership - BLM, private, National Forest, or Indian reservation;
- o Environmentally sensitive areas such as wildlife management area or potential wilderness area.

The geographical locations of all the passes studied are shown in Drawing 1 (presented at the end of the report). Photographs of three typical passes with rankings of I, III, and V are presented in Photos 1 through 3.

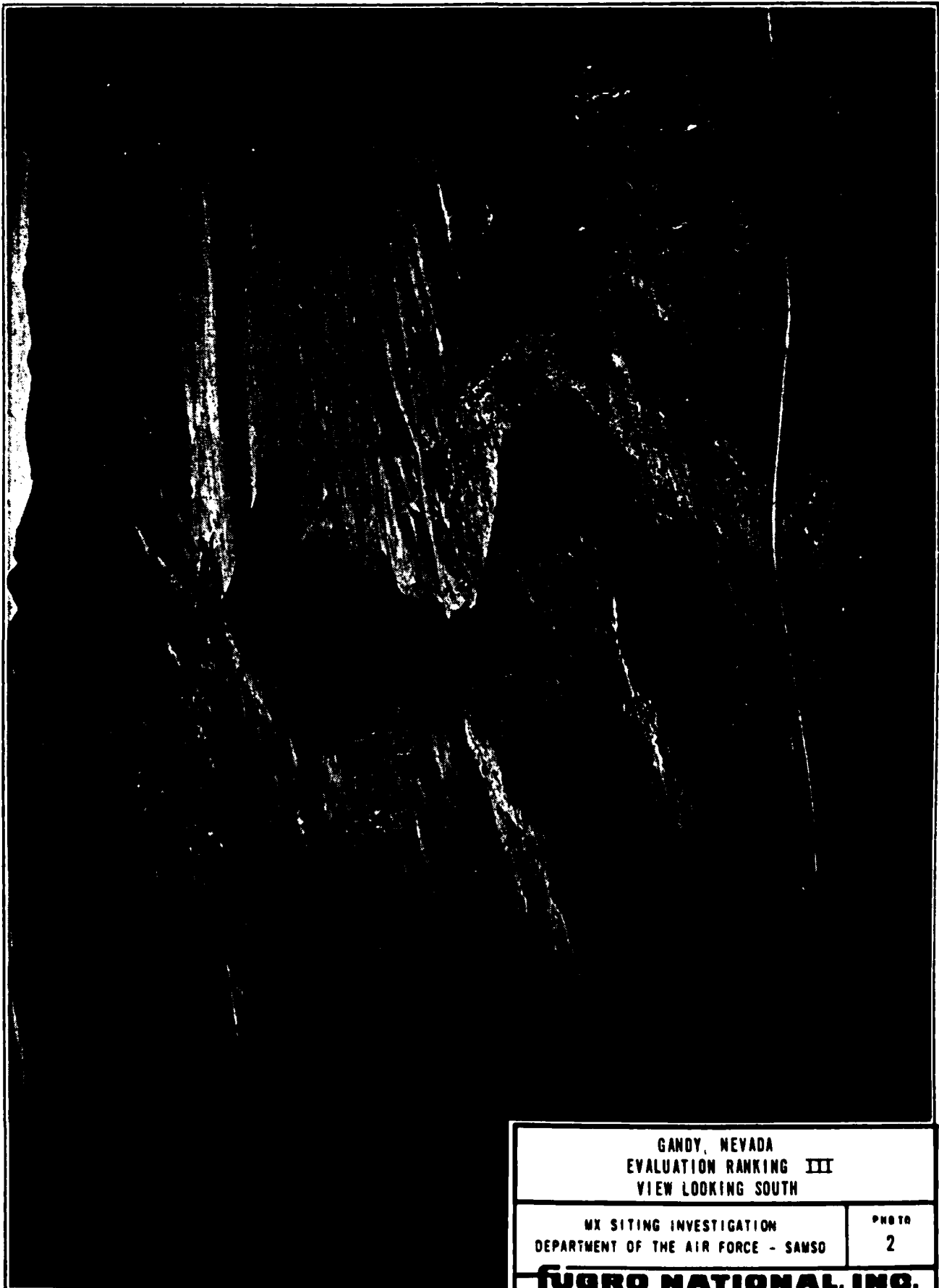


SIDENHILL PASS, NEVADA
EVALUATION RANKING I
VIEW LOOKING EAST

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAUSO

PHOTO
1

FUGRO NATIONAL, INC.



GANDY, NEVADA
EVALUATION RANKING III
VIEW LOOKING SOUTH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMS0

PHOTO
2

FUGRO NATIONAL, INC.



MARJUM PASS, UTAH
EVALUATION RANKING **I**
VIEW LOOKING NORTHWEST

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMS

PHOTO
3

FUORD NATIONAL, INC.

4.2 Existing Railroad Lines

Existing standard gauge railroad lines adjoining the Nevada-Utah siting area are:

- (1) the Union Pacific Railroad main line extending southwest from Delta, Utah to Caliente, Nevada;
- (2) a Union Pacific spur line extending northward from Caliente through Panaca and Pioche to Caselton, Nevada;
- (3) the Nevada Northern Railroad with its southern terminus at Ely, Nevada; and
- (4) the Southern Pacific Railroad from Reno to Mina, Nevada.

The railroad lines are shown in Figure 1.

The existing railroad lines which could be readily observed were evaluated. The line from Delta to Caliente sustains heavy usage and is assumed to be well maintained. The spur line from Caliente to Caselton is in use and is being maintained. This trackage has good alignment with light curvature, but the physical condition of the track was not investigated.

The Nevada Northern line extending north from Ely is constructed of jointed light weight rail, 70 lb. per yard, and appears to be in fair physical condition. Spur lines from Ely to the McGill smelter and the Kennecott copper mine at Ruth employ heavier 90 lb. rail. The line north from Ely remains in use although the Ruth mine has been closed for more than one year. This line is apparently suitable for freight shipments of moderate tonnage. Presently, there is only one operating engine providing all services and deliveries. If the line becomes a major connection for the MX railroad system, freight tonnage and

reliability requirements may dictate some reconditioning or possibly upgrading to heavier rail.

The railroad line from Reno to Mina was not evaluated. In addition, an old railroad grade exists from Mina to Tonopah and Goldfield, Nevada. The tracks from this grade were removed in the early 1940's.

5.0 RECOMMENDATIONS

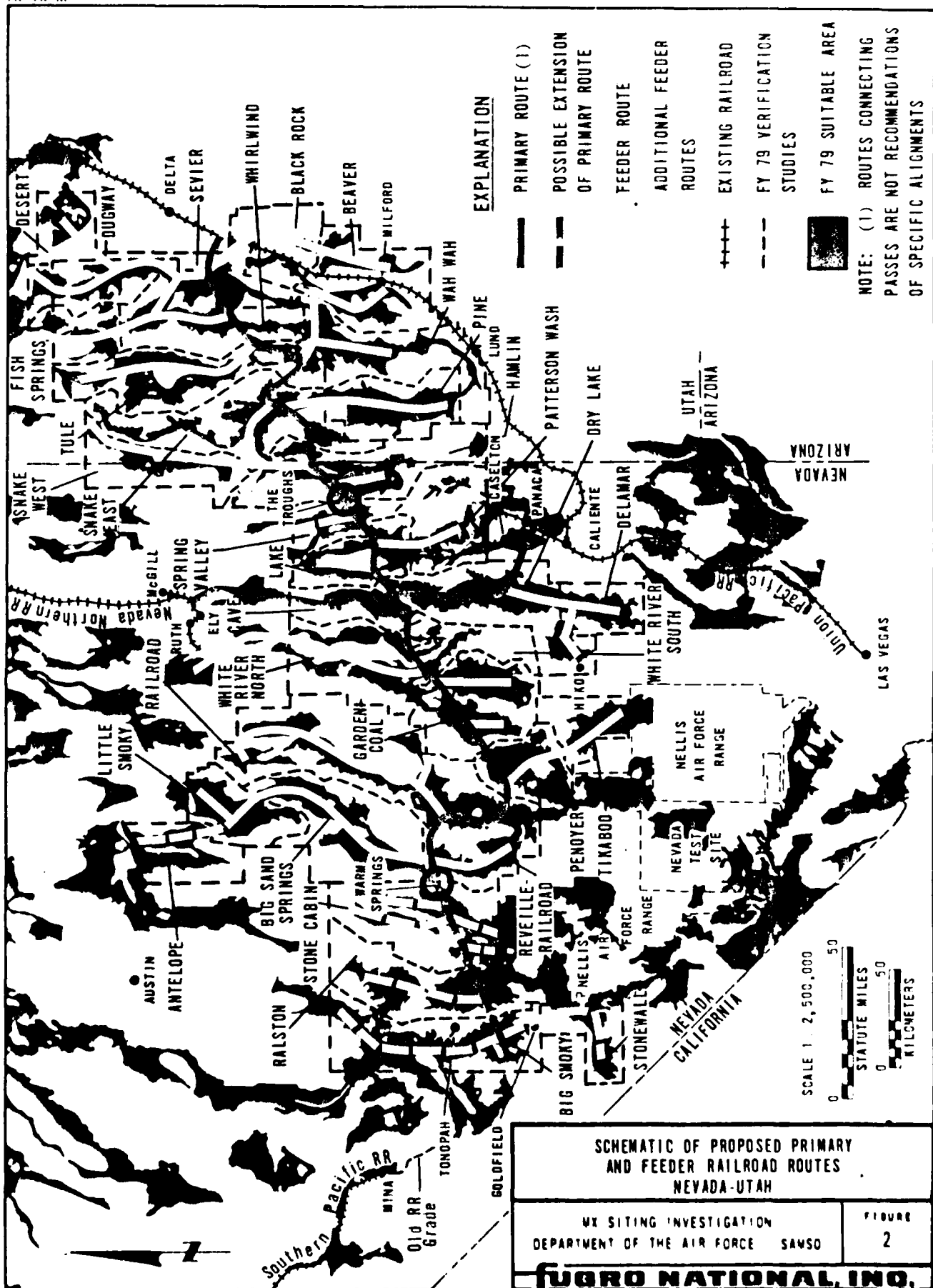
5.1 Railroad Route Recommendations

Upon completion of the ranking, a preliminary railroad system was developed to link geotechnically suitable areas in the Nevada-Utah study area. Passes with rankings of IV or V were not used. This recommended system includes:

- o A direct, primary east-west route with an eastern terminus near Delta, Utah and western terminus in northern Reveille Valley with an extension into Big Smoky Valley;
- o A primary north-south route from Ely to Panaca which links existing Nevada rail lines; and
- o North-south feeder lines from primary routes into potential deployment valleys.

The recommended railroad routes are shown in Drawing 2 and a schematic of the routes is shown in Figure 2. Details of the passes traversed by the primary routes are summarized in Table 1. The approximate lengths of recommended routes are:

<u>Description</u>	<u>Length, miles</u>
PRIMARY ROUTES:	
East-West	265
North-South	120
Western Extension	60
FEEDER ROUTES:	
Off the Primary Routes	930
Off the Western Extension	215
Additional Northern Extension	120
TOTAL	<u>1710</u> miles



FUGRO NATIONAL, INC.

The alignment of the primary east-west route was controlled by two passes, The Troughs in eastern Nevada and Warm Springs in central Nevada. The Troughs is between Hamlin and Spring Valleys. It is the only east-west pass with a ranking less than IV for a distance of 70 miles to the north or south. Warm Springs is between Reveille and Stone Cabin Valleys. This pass is the only access with a ranking less than IV to the north or south in the study area.

Feeder routes are presented as dead-end tracks. They generally do not go through a pass. In many instances, they can be connected through passes to create loops both north and/or south of the primary east-west route. In addition, the extremities of the feeder routes could be connected to form alternate primary routes. The alternate primary routes are not shown.

5.2 Future Studies

Future studies, required prior to railroad construction, include:

- o Primary and feeder line route selection;
- o Topographic mapping;
- o Right-of-way studies;
- o Environmental impact statements;
- o Geotechnical investigations along the selected routes;
- o Final design;
- o Field construction control surveys; and
- o Availability of construction materials;

Due to the magnitude of the MX project, a staged construction sequence is anticipated. After initial base and deployment

area selection, preliminary railroad routes should be selected. First priority should be given to the primary routes. Once these routes have been selected, routing of feeder lines can begin. The location of the feeder routes must be coordinated with the layout of shelter clusters so that layout criteria are met. Routes must be located to avoid conflict with existing cultural developments, environmentally sensitive areas, and mineral resource areas. Preliminary alignments should be established by field inspection of initial routes to determine the best physical location based on terrain features, grade and alignment criteria, and future route extension requirements.

Control points should be established along the preliminary alignment and surveyed to develop location and elevation control for aerial photography. Topographic strip maps at a scale of 1:2400 (1":200 feet) and five-foot contour intervals should be developed for a corridor centered on the preliminary alignment.

A mathematical terrain model should then be developed by digitizing surface elevations along the corridor center line and on sections normal to the center line. A computer program can then establish alignment, grade, roadbed criteria, head room required for bridges and culverts and grading quantities. By examining the results and re-running the data with revised alignments and grades, the optimum location can be established. This computer method permits rapid study of all viable alternatives in a short period of time.

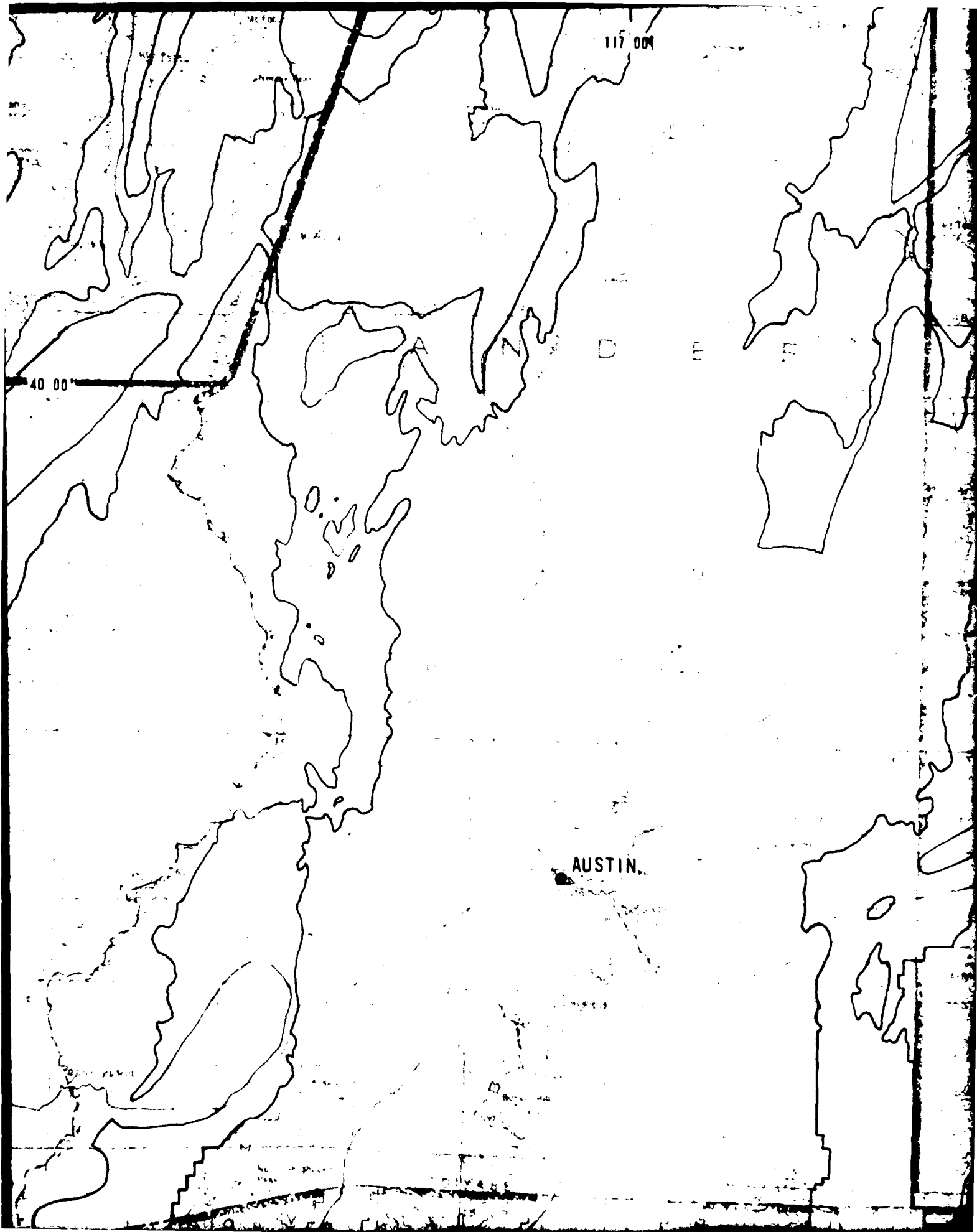
After the optimum alignment is established, right-of-way studies and environmental impact reports should be initiated to assure timely right-of-way acquisition. Geotechnical investigations should be initiated to determine the following:

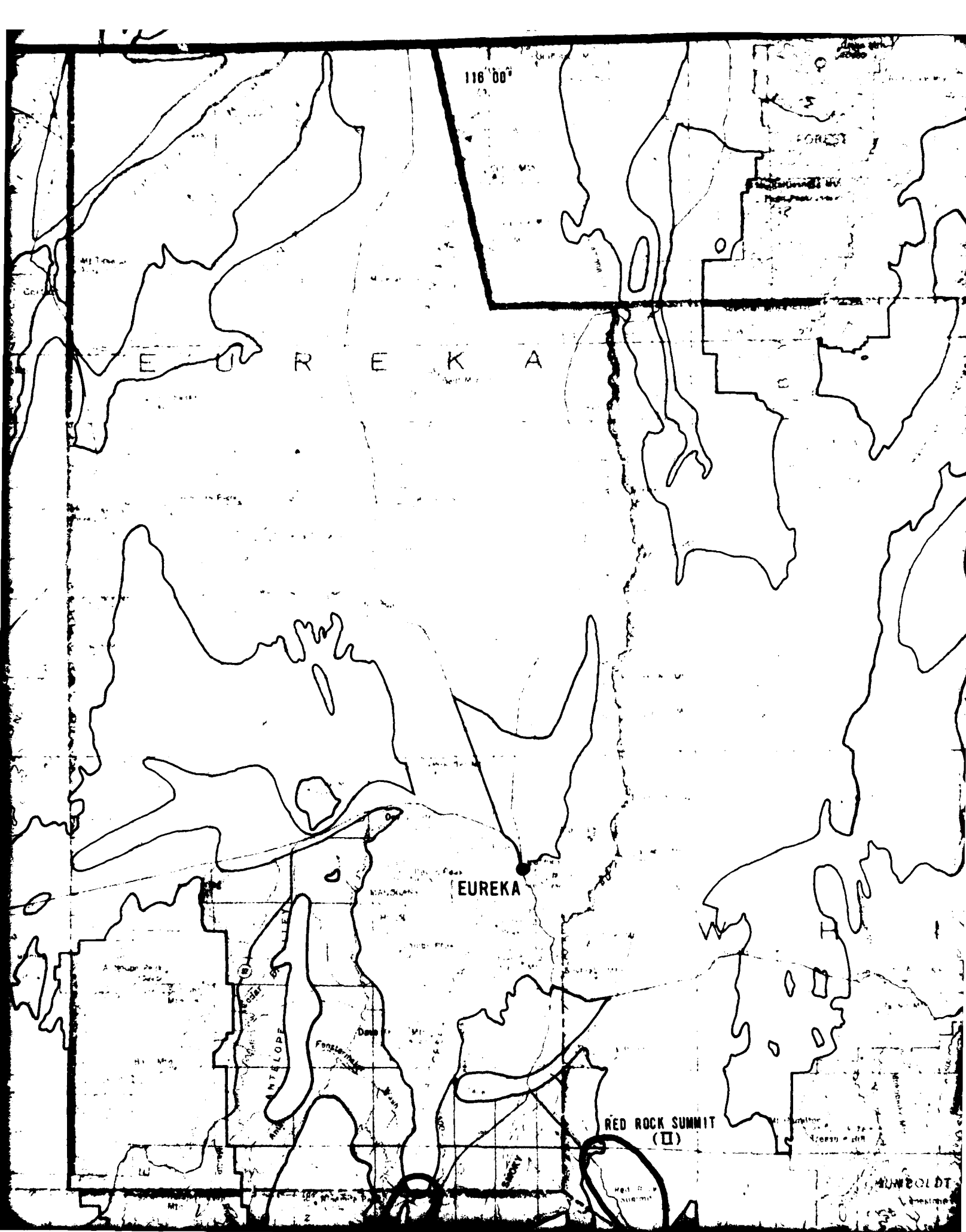
- o center line soil and rock profiles;
- o excavation difficulties;
- o suitability of excavated materials for embankment construction;
- o shrink-swell characteristics of excavated materials; and
- o stability of cut slopes and embankment sections.

Final designs, including drainage structures, can then be developed from the above data. The final computer output will establish calculated center line co-ordinates with curve data and preliminary grading quantities for bid. The final route can be established in the field for construction from previously set field photo control points.

Based on the information available to the railroad consultant, total annual plant capacity for new rail, fastenings and cross ties, manufactured in this country, is allocated well in advance of delivery. The considerable quantities required for this project must come from the same sources used by the nation's railroads, and a very early allocation must be secured to ensure availability at the desired construction time. A local source for railroad ballast should be selected, proven by subsurface investigation, and environmentally cleared so that quarrying and

crushing operations can begin concurrently with road bed grading. The present MX aggregate resource studies can probably define the desirable quarry sites.





115 00

NEVADA NORTHERN R.R.

GANDY (IX)

ROBINSON SUMMIT (IX)

McGILL

RIE PETOWN (IX)

ELY

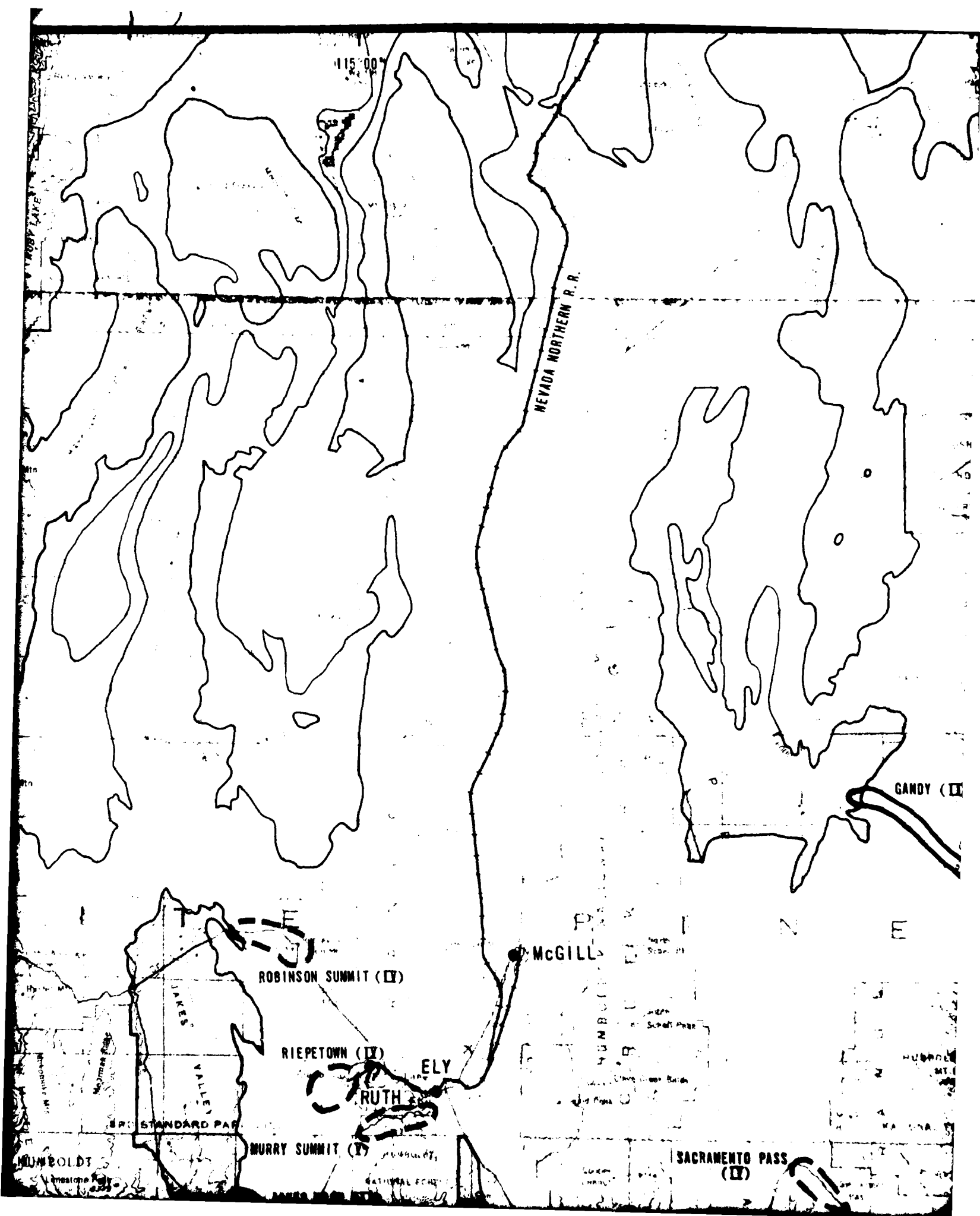
RUTH

MURRY SUMMIT (IX)

SACRAMENTO PASS (IX)

STANDARD PA

HUMBOLDT



114°00'

UTAH TEST AND TRAINING RANGE

113°00'

U.S. ARMY
DUGWAY PROVING GROUND

DUGWAY PASS (Y)

HONEYCOMBS (I)

TOPAZ 5 (II)

TOPAZ 1 (I)

TOPAZ 2 (I)

GRANITE MTN. (III)

FLAT

GANDY (III)

SMELTER
KNOLLS (IV)

SAND
PASS (II)

TOPAZ 4 (IV)

TOPAZ 3 (III)

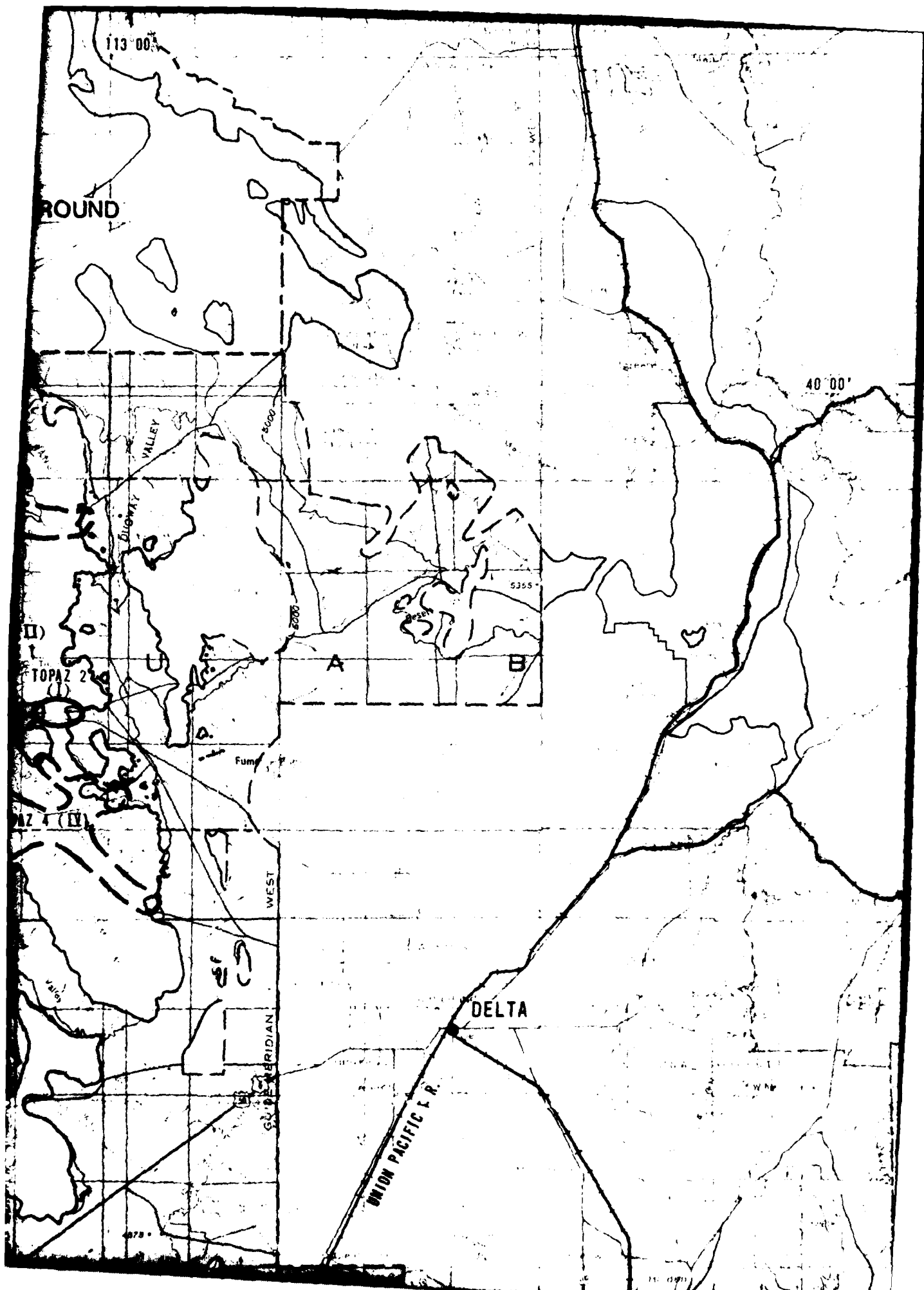
AN ARD PARALLEL SOUTH

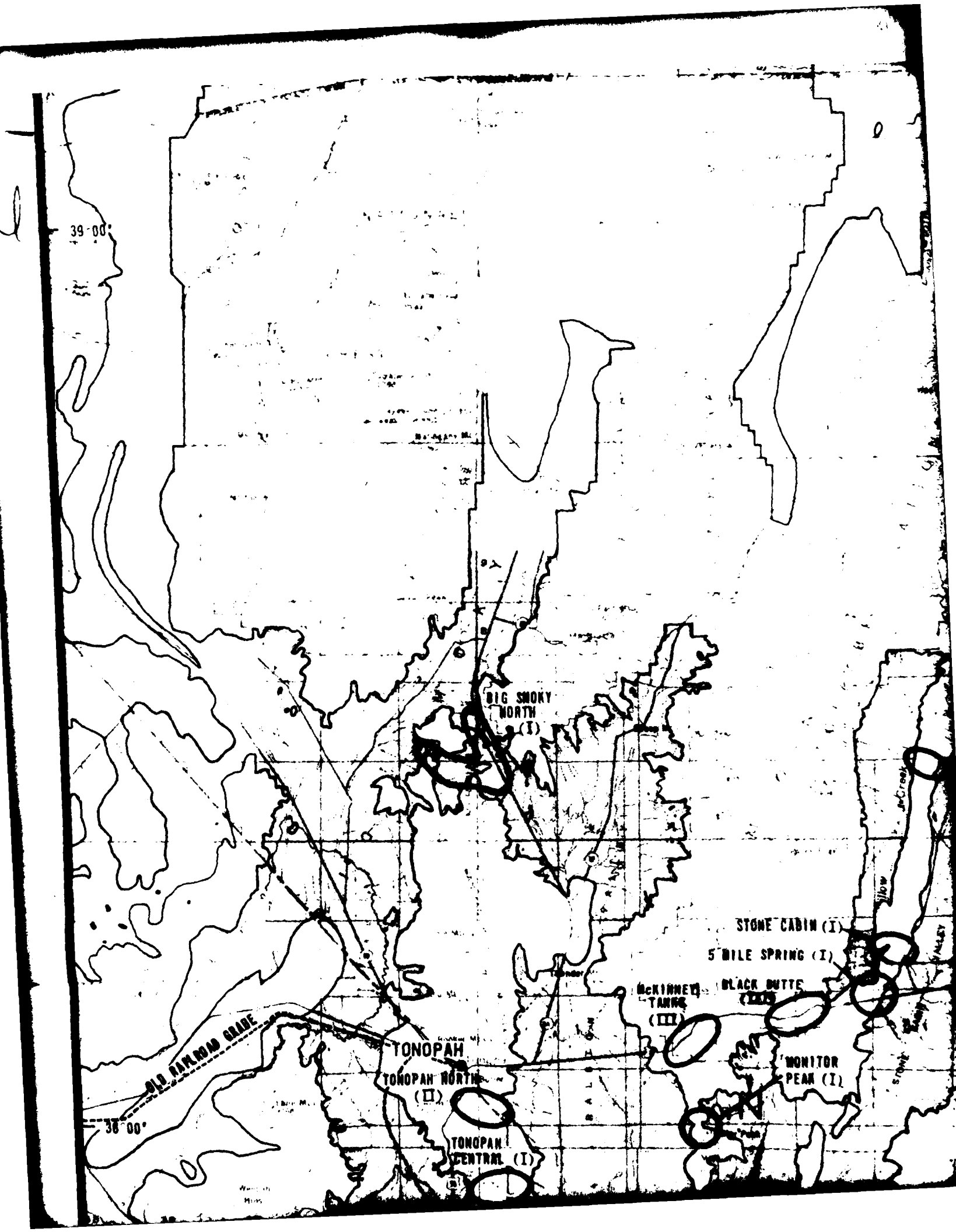
DOMO CANYON PASS (Y)

COWBOY PASS (I)

MARIUM PASS (X)

2ND GULF





39° 00'

BIG SMOKY
NORTH
(I)

STONE CABIN (I)

5 MILE SPRING (I)

McKINNEY
TANKS
(II)

BLACK BUTTE
(I)

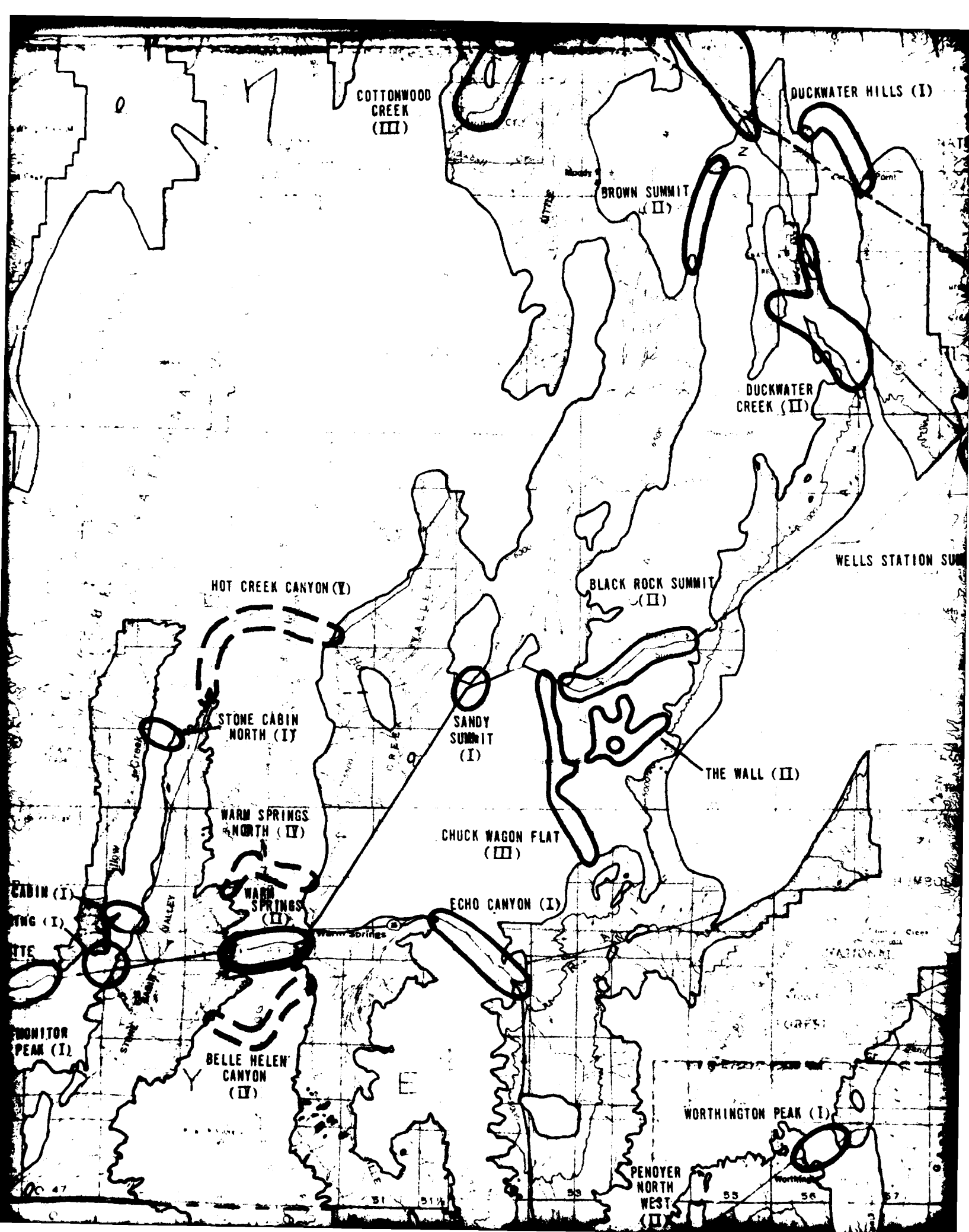
MONITOR
PEAK (I)

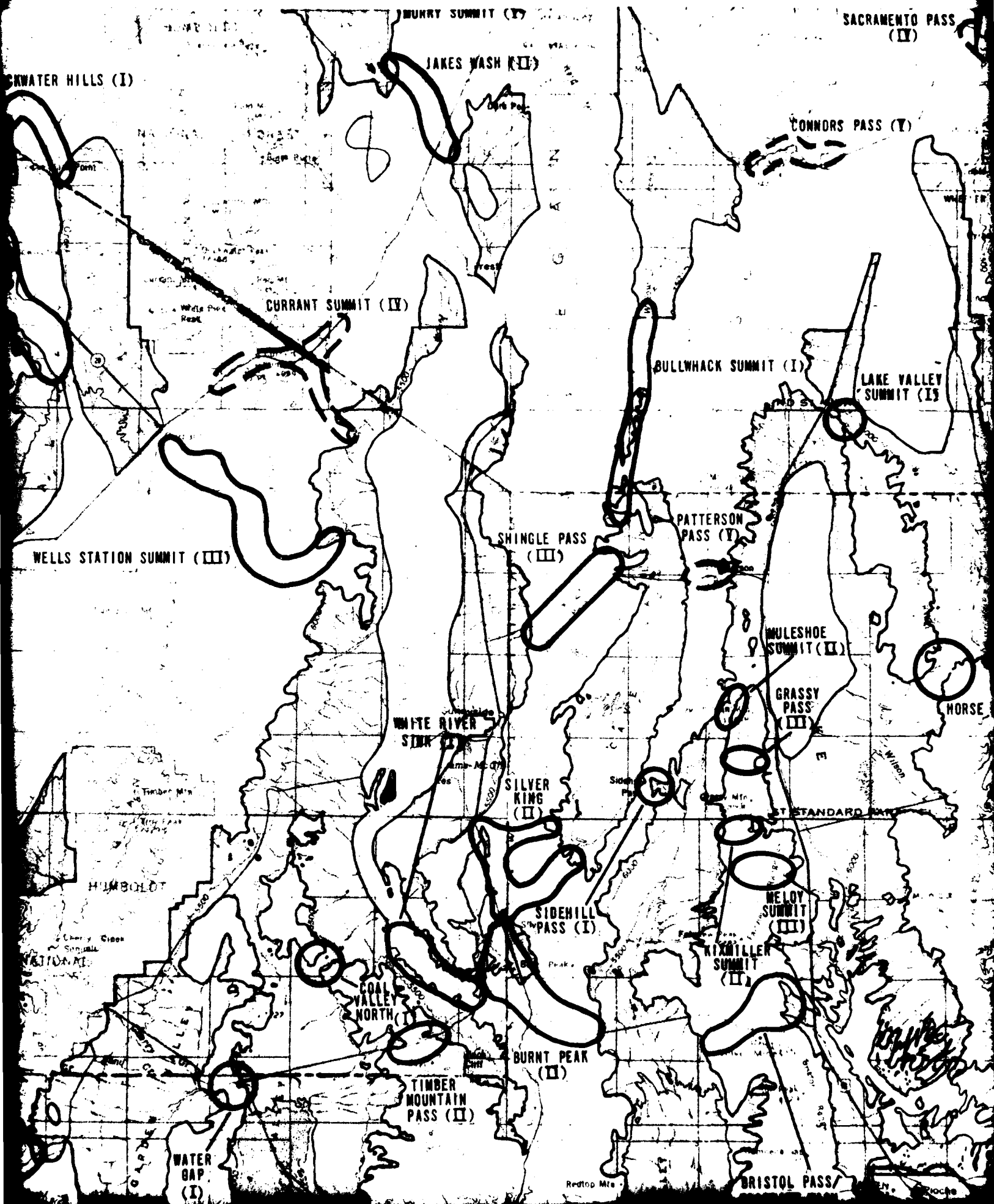
TONOPAH
TONOPAH NORTH
(II)

TONOPAH
CENTRAL (I)

38° 00'

OLD RAILROAD GRADE





GRAMENTO PASS (IX)

PASS (Y)

LAKE VALLEY SUMMIT (IX)

THE TROUGHS (I)

HORSE CORRAL PASS (I)

COWBOY SPRINGS (II)

KINGS CANYON (Y)

SKULL ROCK PASS (III)

STANDARD

FRUSON DES

SNAKE PASS (II)

STEAM BOAT PASS (I)

PINE WEST (IX)

PINE PASS (I)

CRYSTAL PEAK PASS (IV)

HALFWAY SUMMIT (IV)

MORMON GAP (I)

WAH WAH SUMMIT (IX)

FRISCO SUMMIT (II)

WAH WAH WASH (I)

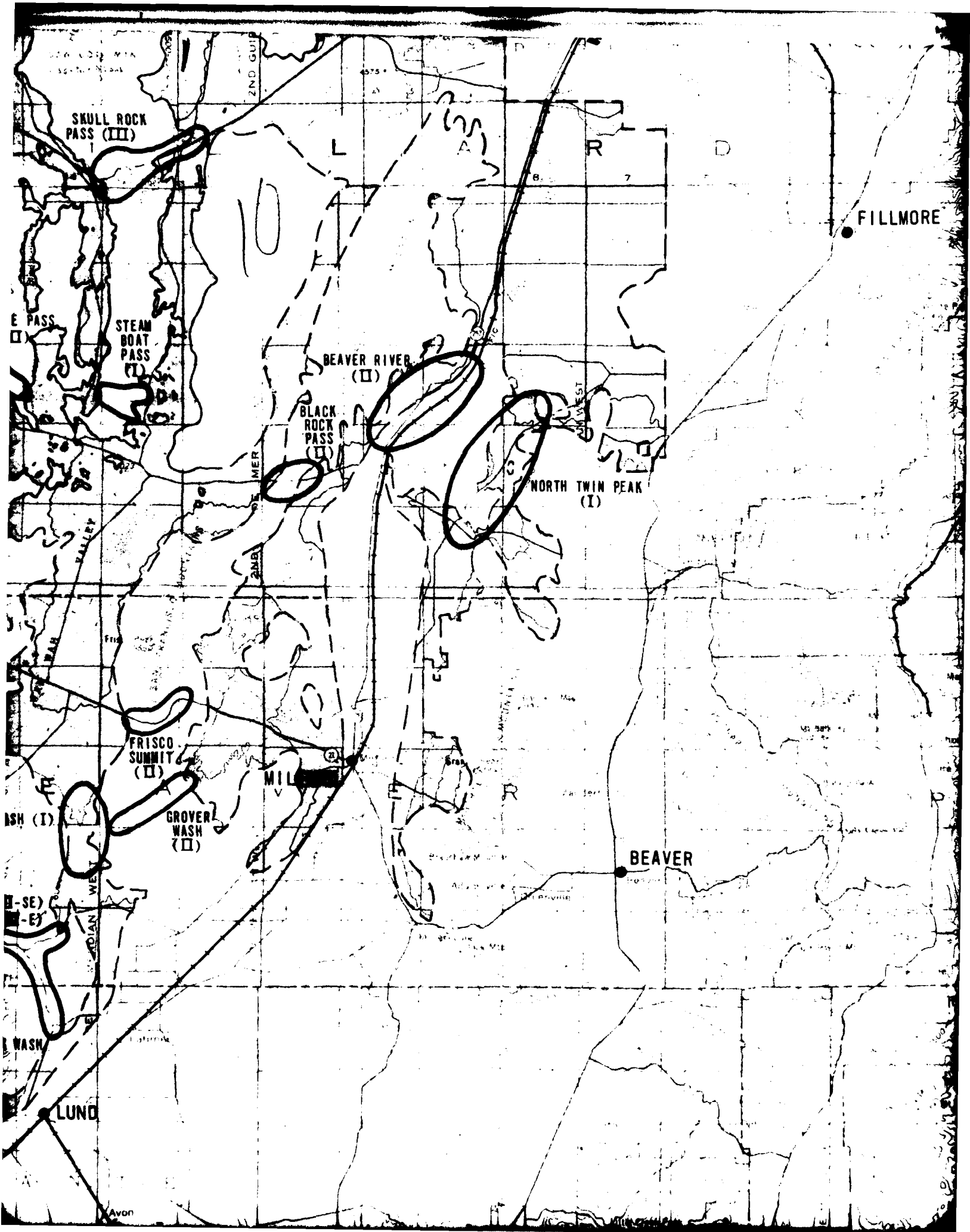
LOCKEY ROAD (II-SE) (III-E)

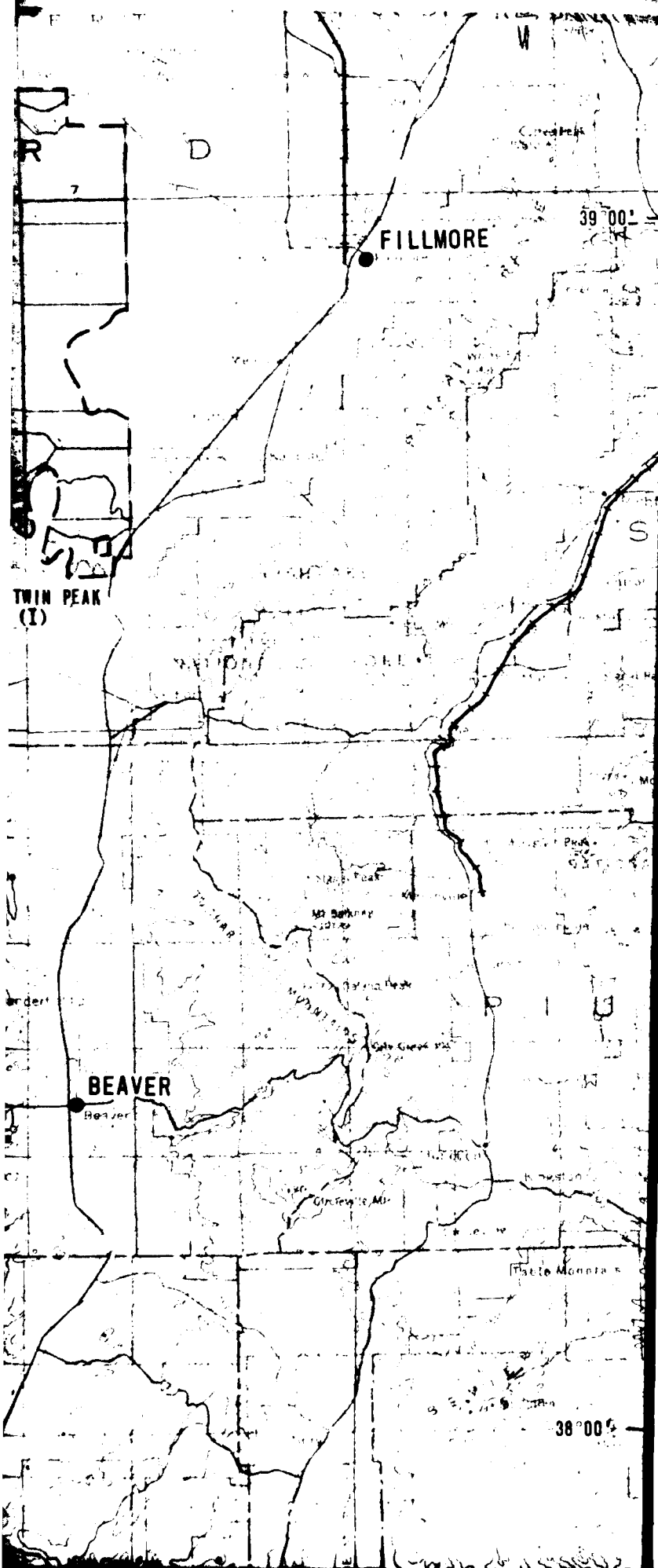
MOUNTAIN SPRING WASH (II)

LUND

PLOCHE

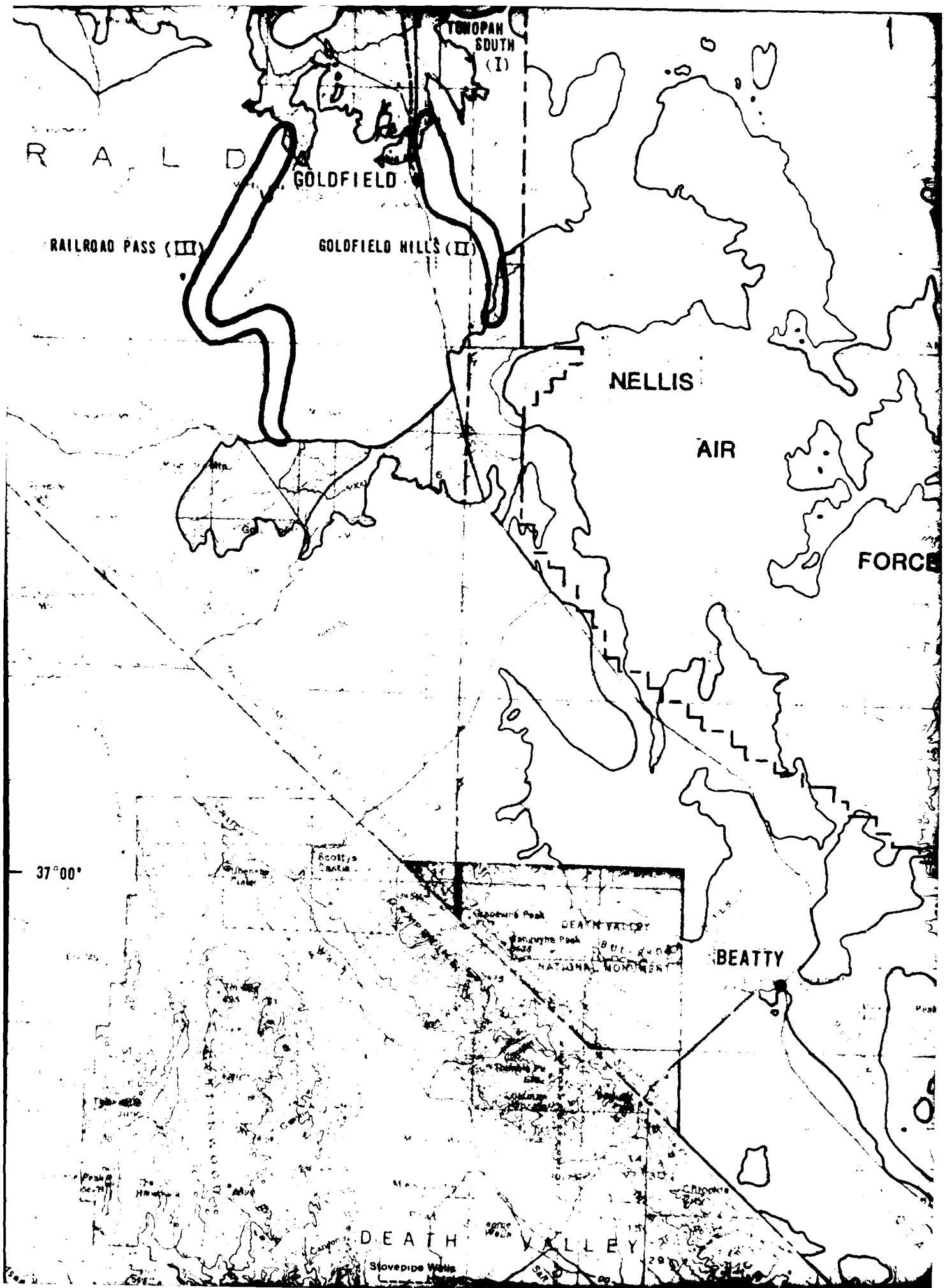
WAG R.R.

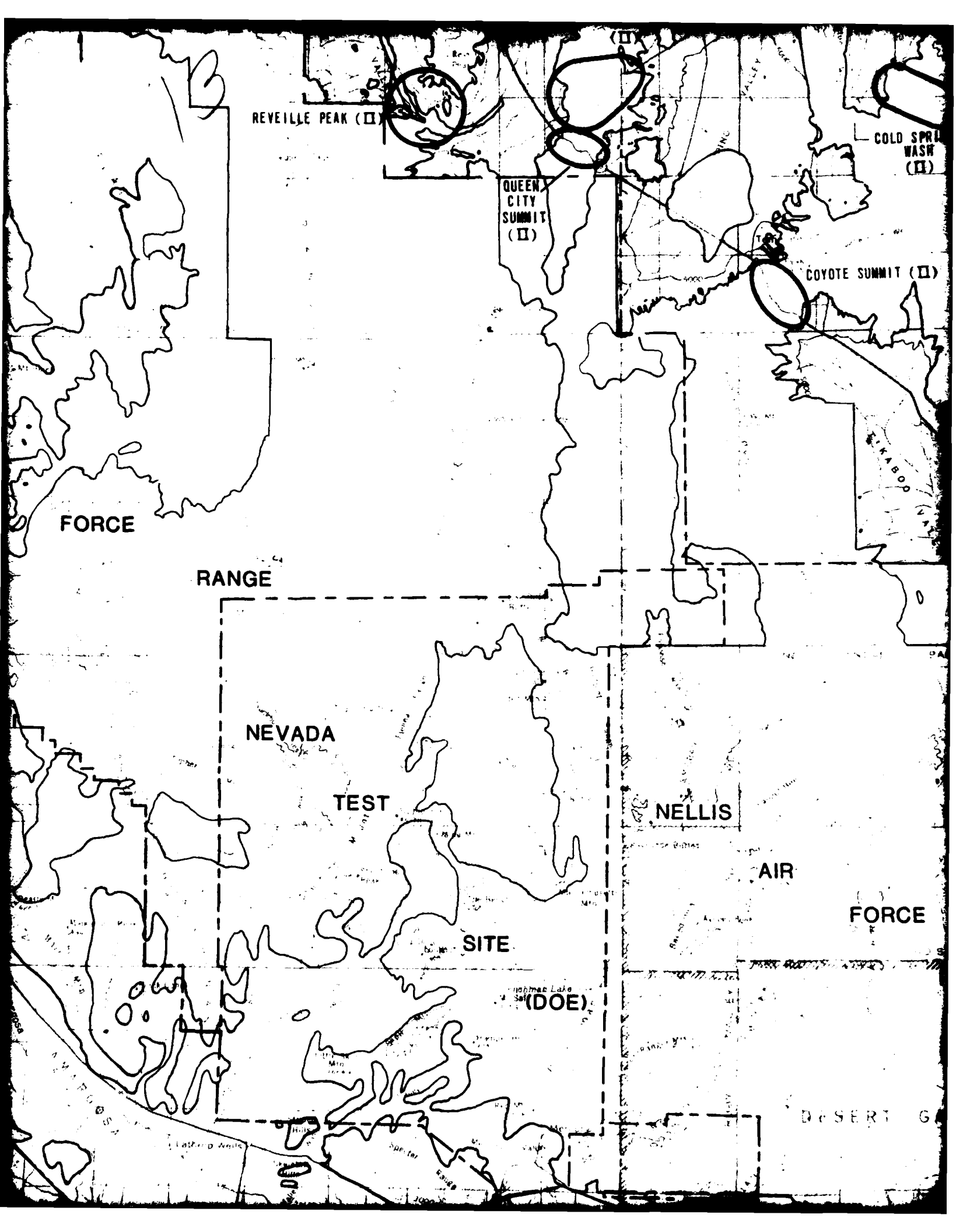




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11





REVEILLE PEAK (X)

QUEEN
CITY
SUMMIT
(X)

COLD SPRING
WASH
(X)

COYOTE SUMMIT (X)

FORCE

RANGE

NEVADA

TEST

NELLIS

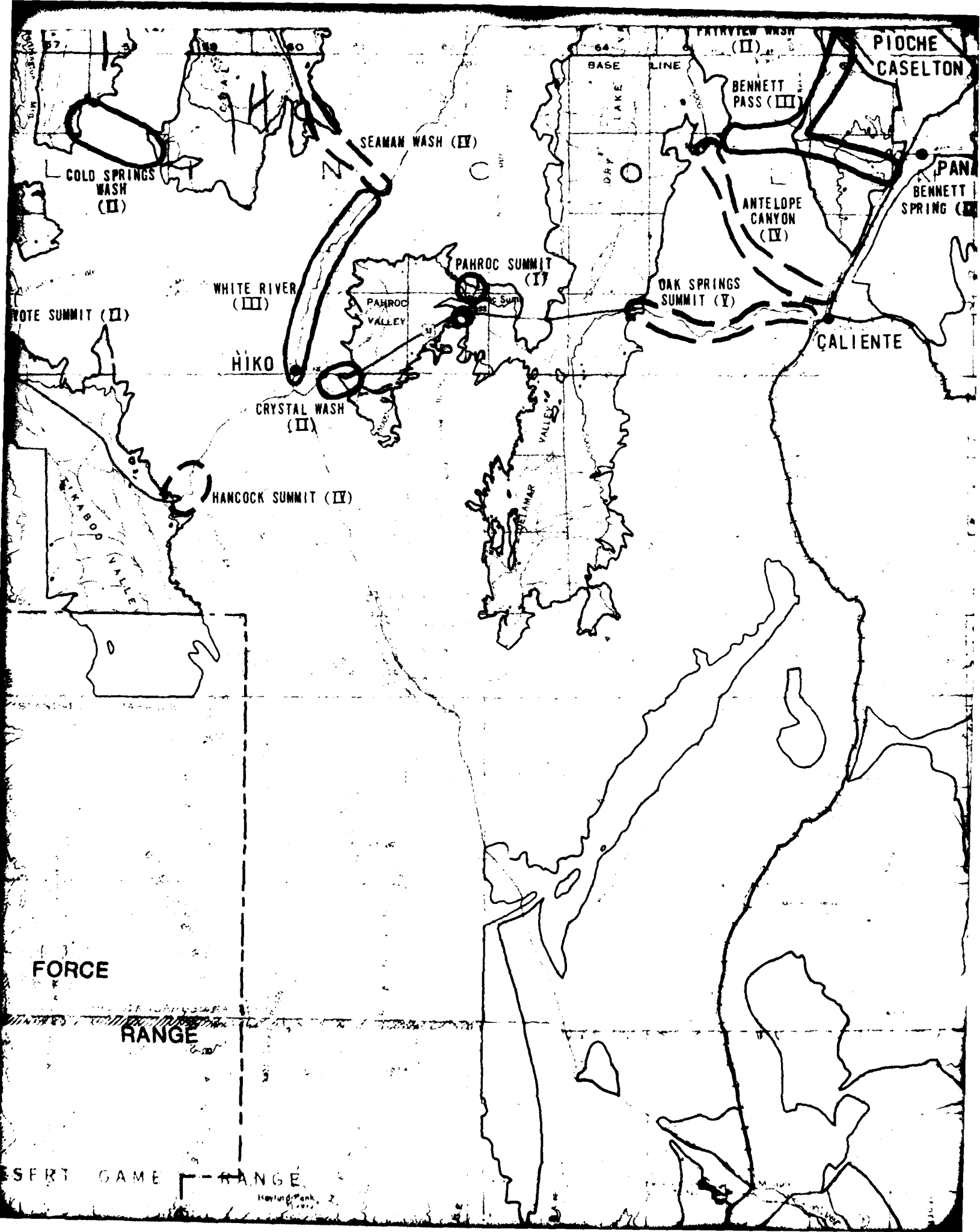
AIR

FORCE

SITE

Highman Lake
(DOE)

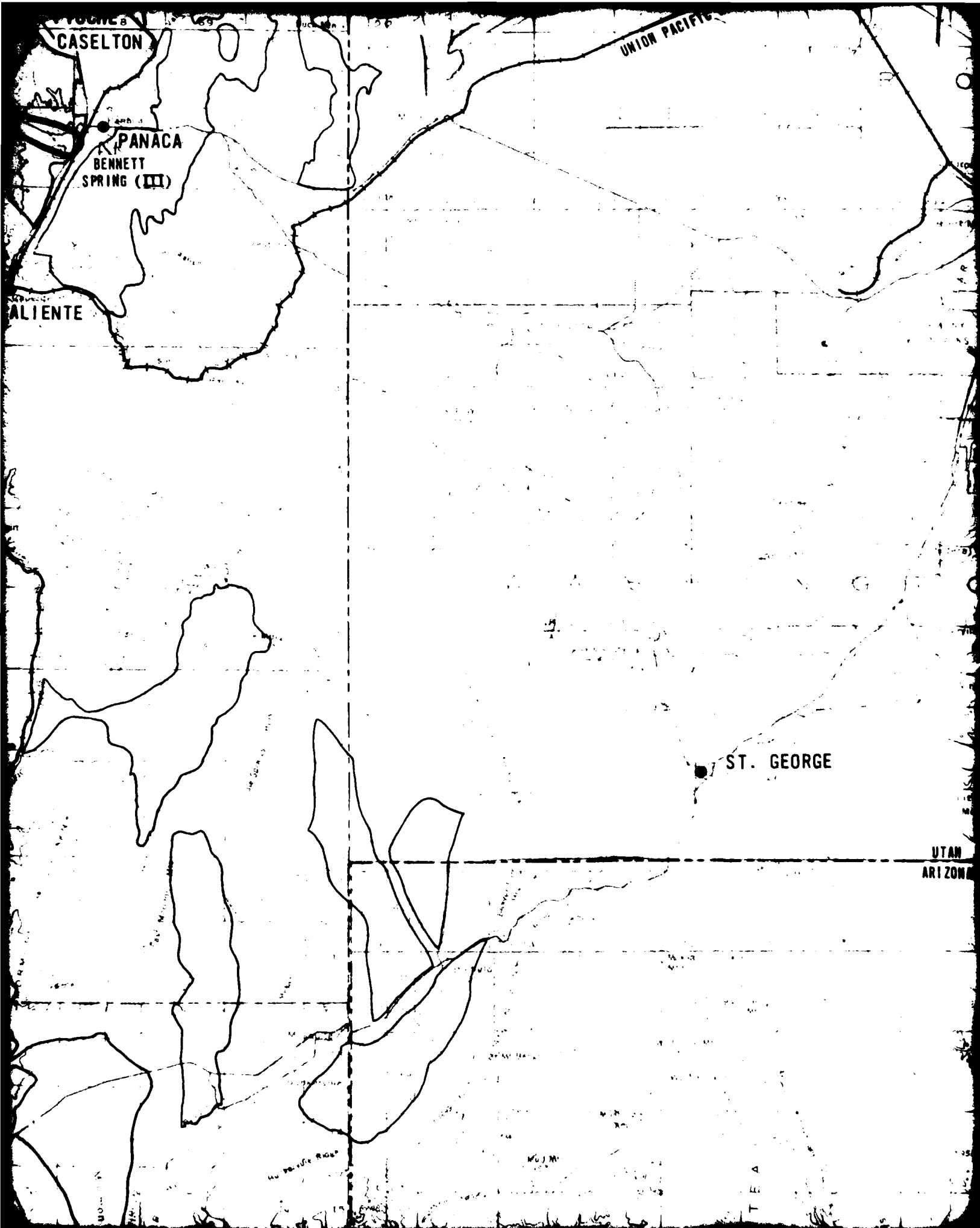
DESERT G



FORCE

RANGE

DESERT GAME RANGE



CASELTON

UNION PACIFIC

PANACA
BENNETT
SPRING (III)

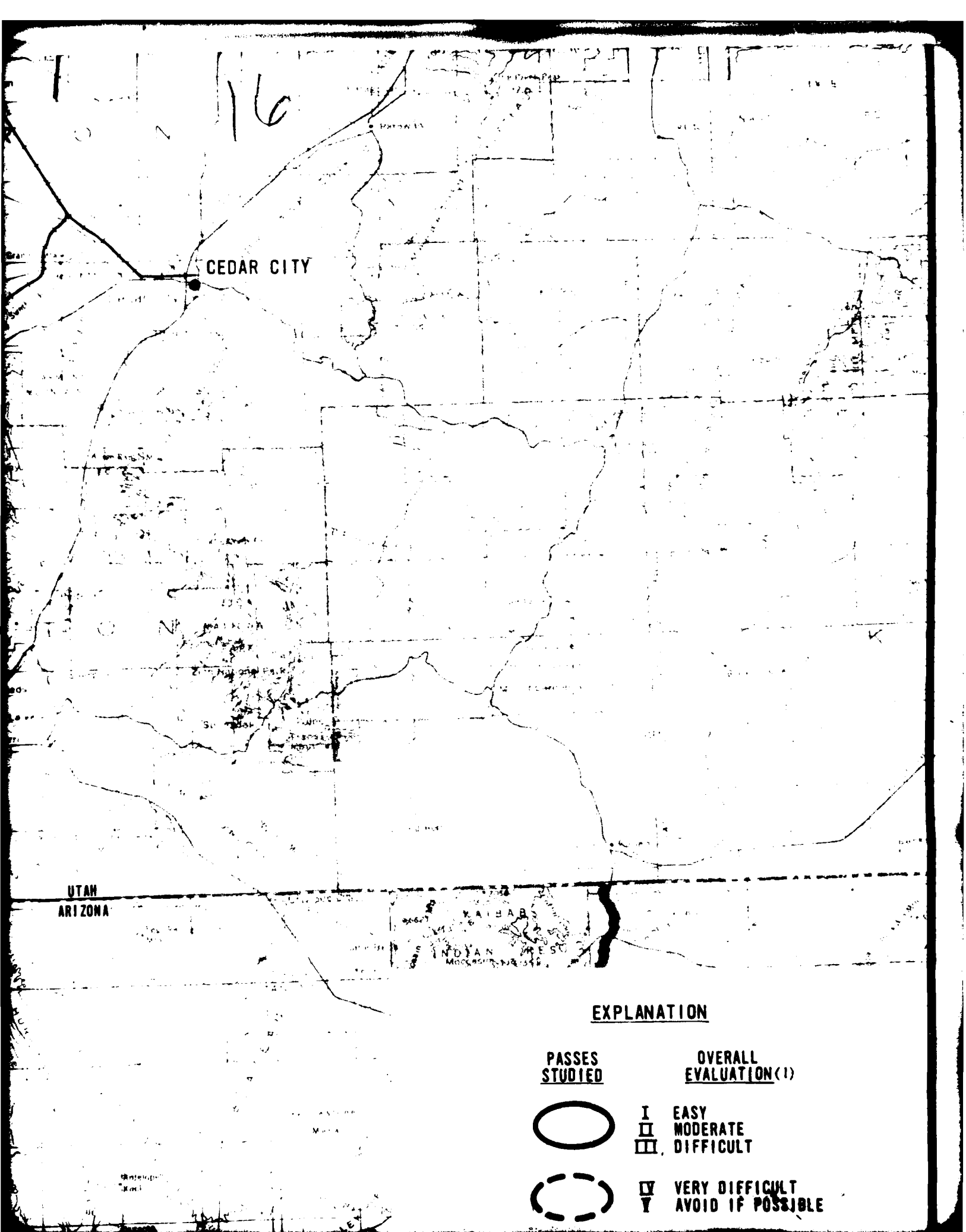
ALIENTE

ST. GEORGE

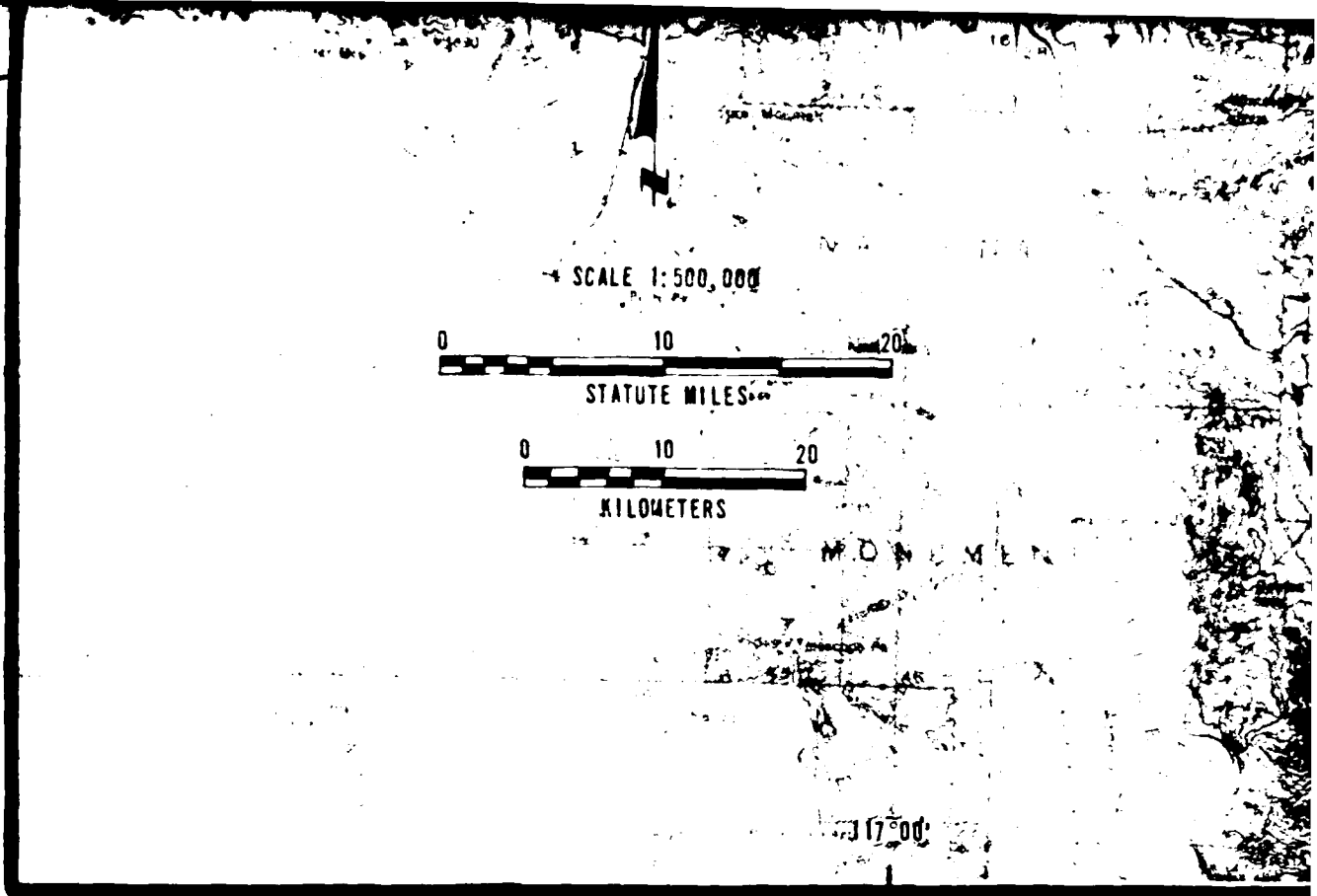
UTAH
ARIZONA

Mojave Ridge

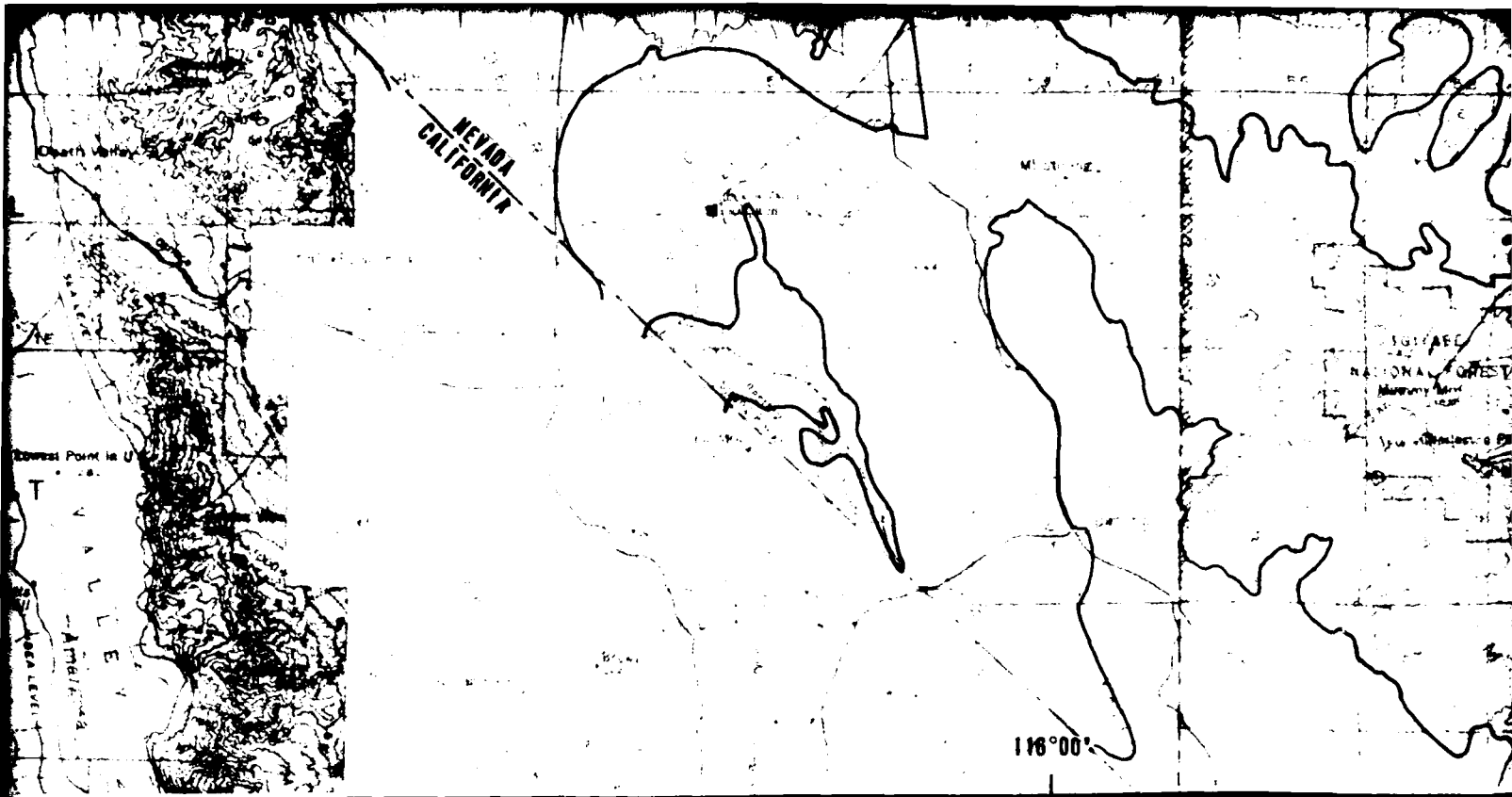
TEA



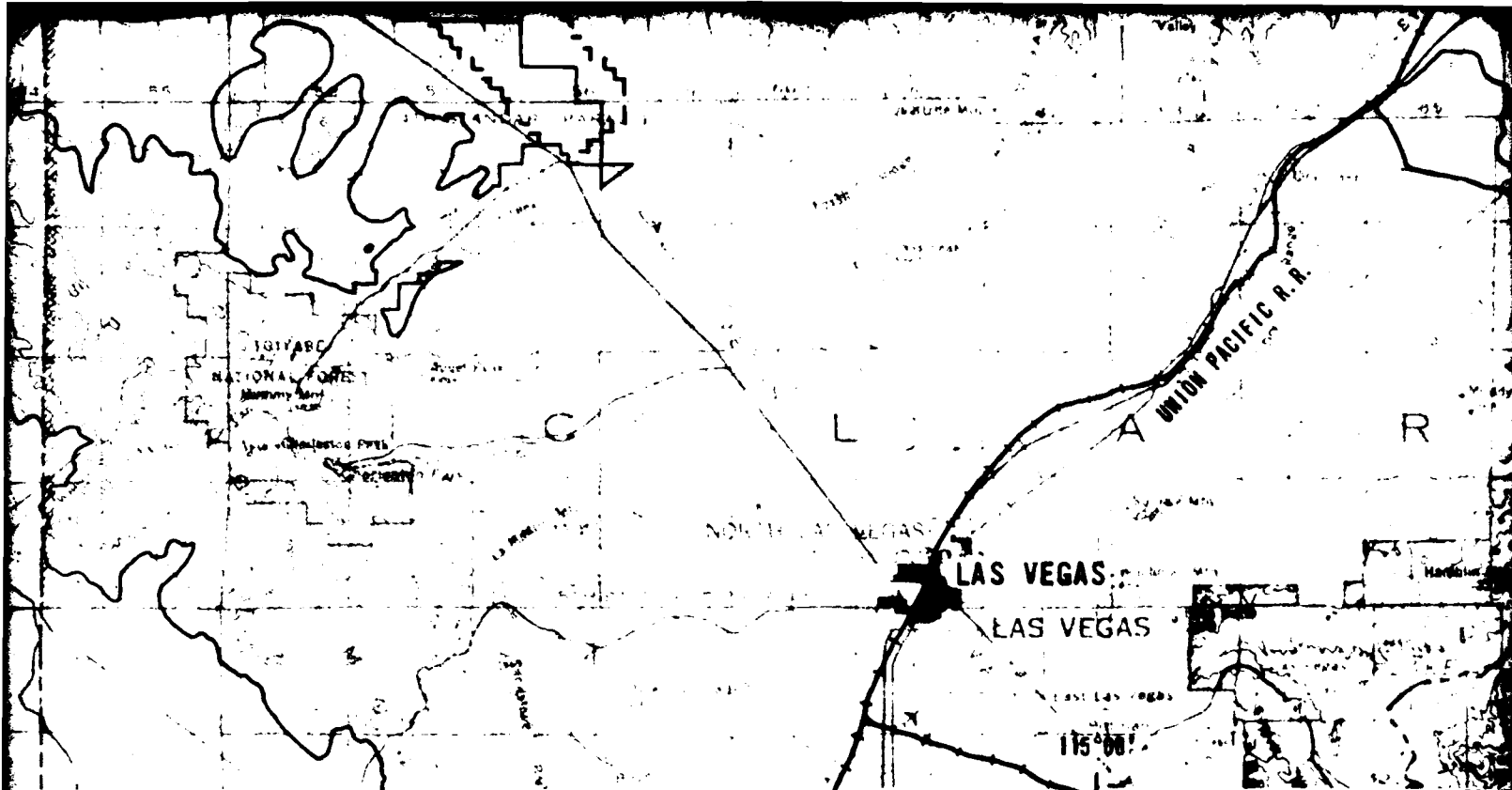
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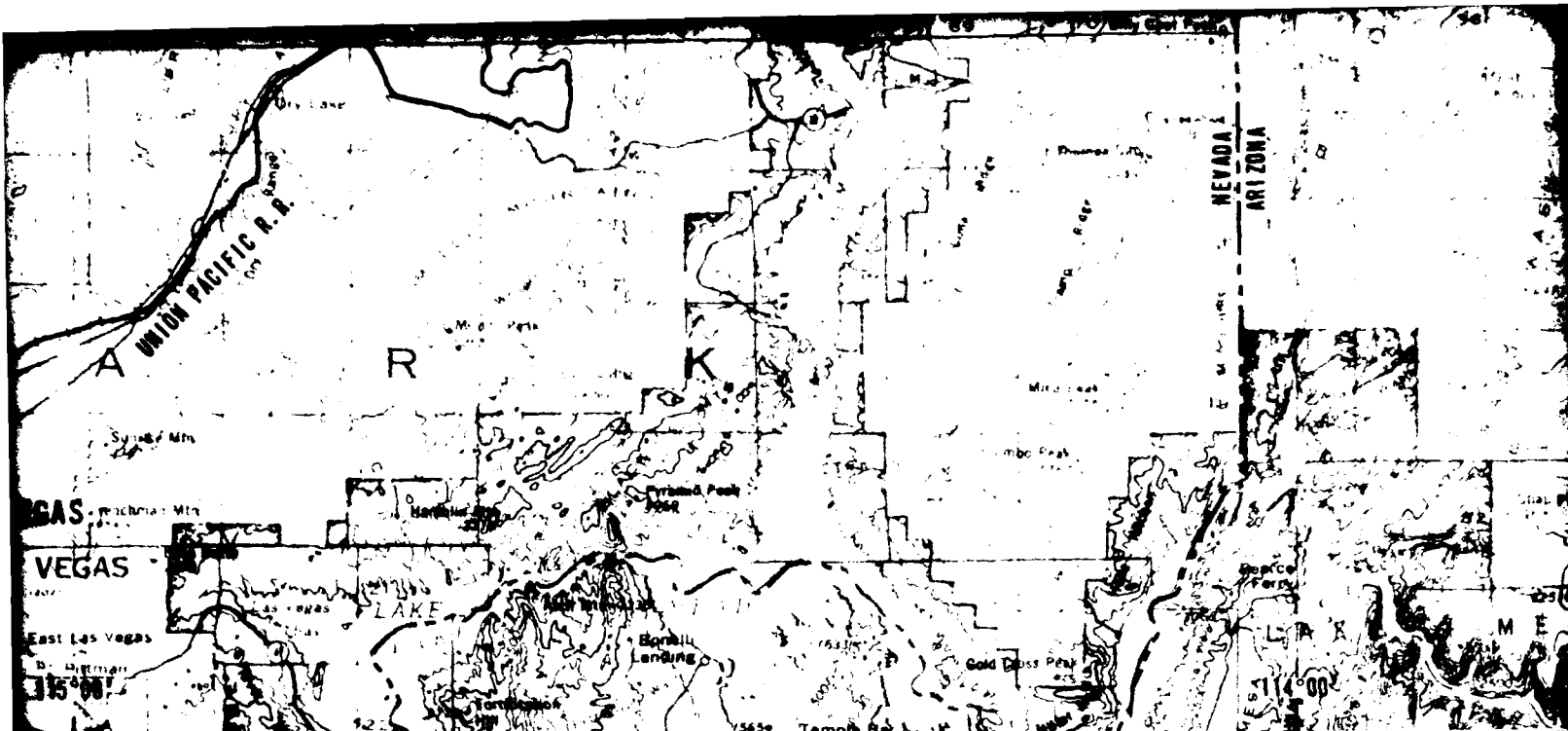
2 NOV 79



1 18



19



128



NOTE: (1)

RAILR

MX SITE
DEPARTMENT OF

FUGRO

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121



IV VERY DIFFICULT
Y AVOID IF POSSIBLE



EXISTING RAILROADS



GEOTECHNICALLY SUITABLE AREA
WITHIN RAILROAD PASS STUDY



GEOTECHNICALLY SUITABLE AREA
BEYOND LIMITS OF RAILROAD PASS STUDY

NOTE: (1) FOR DESCRIPTION OF OVERALL EVALUATION RANKING
AND CATEGORIES SEE SECTION 4.0.

**RAILROAD PASS LOCATION
NEVADA-UTAH**

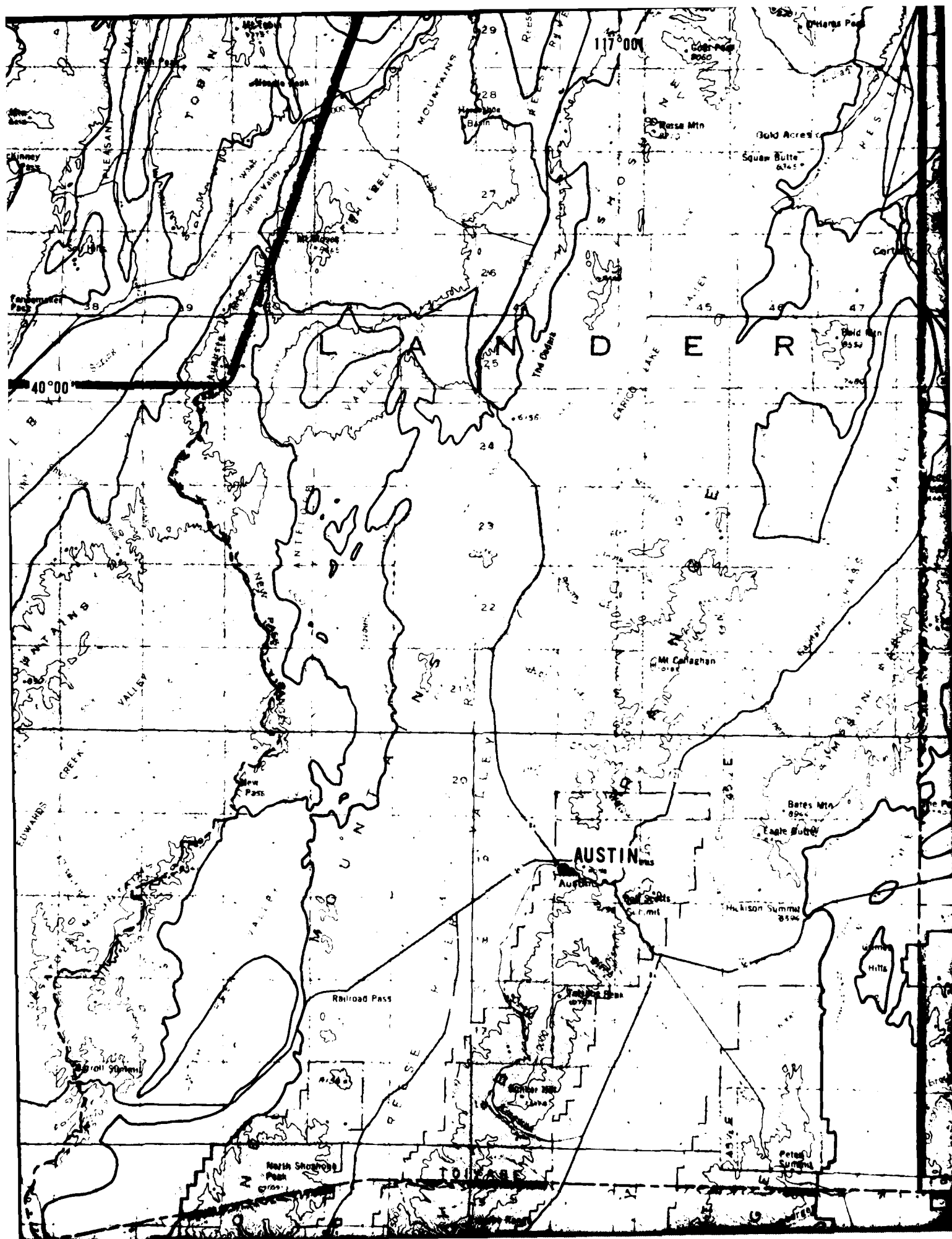
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

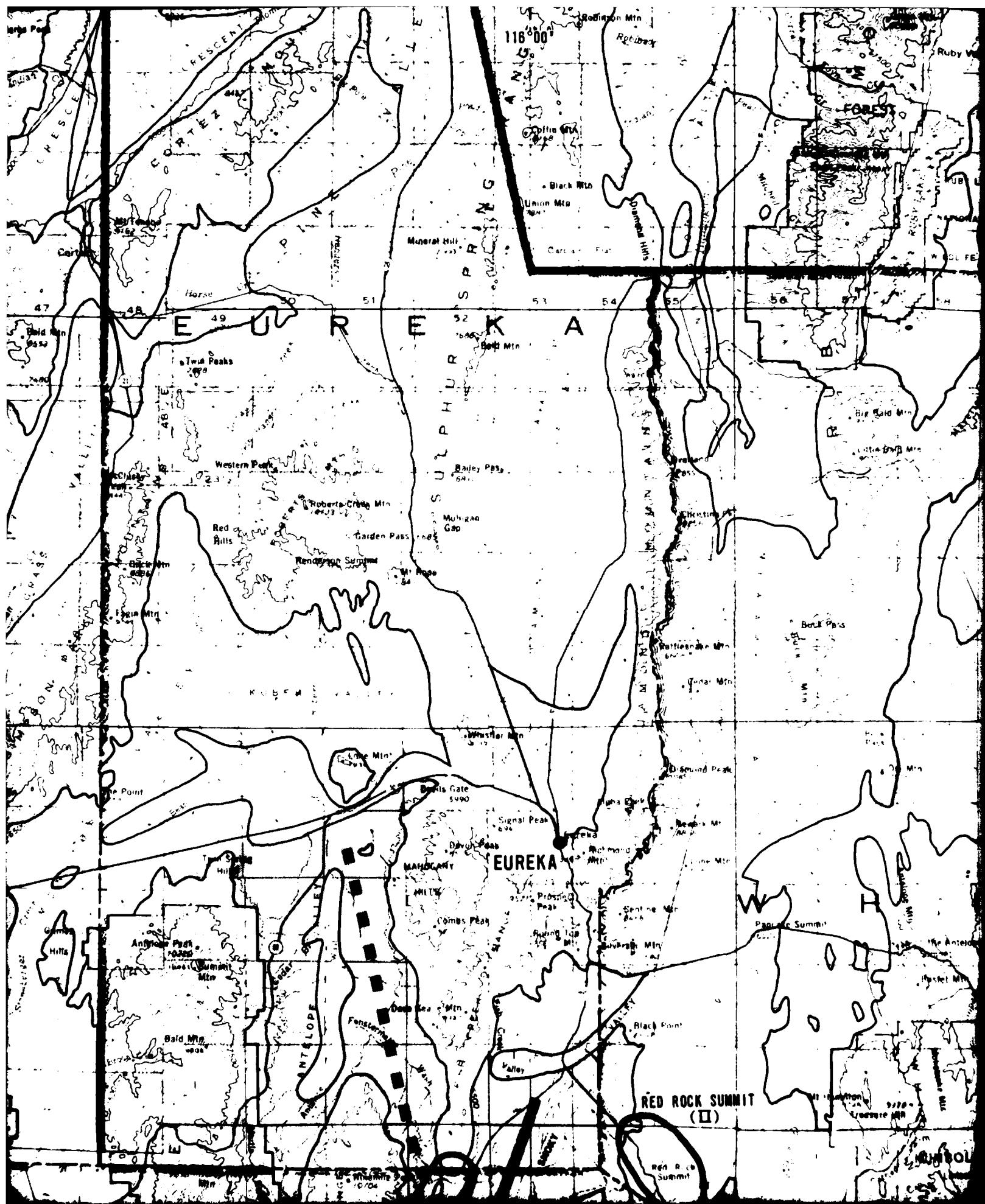
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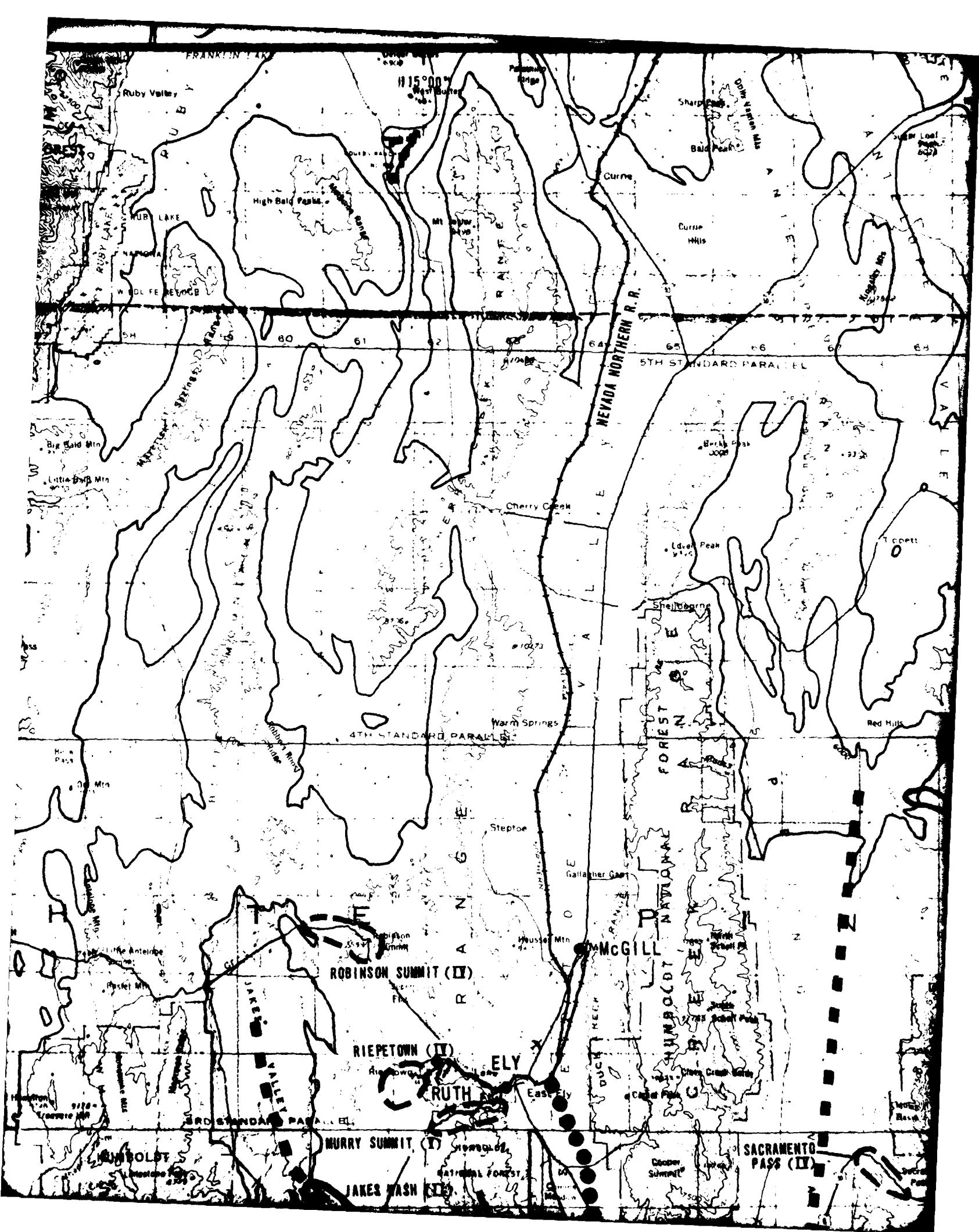
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FUGRO NATIONAL, INC.

132







UTAH TEST AND TRAINING RANGE

U.S. ARMY

DUGWAY PROVING GROUNDS

DESERT

DUGWAY PASS (V)

HONEYCOMBS (I)

GRANITE MTH. (III)

SMELTER
KNOLLS
(II)

SAND
PASS (II)

TOPAZ 32
(III)

DOME CANYON PASS
(I)

COWBOY PASS
(I)

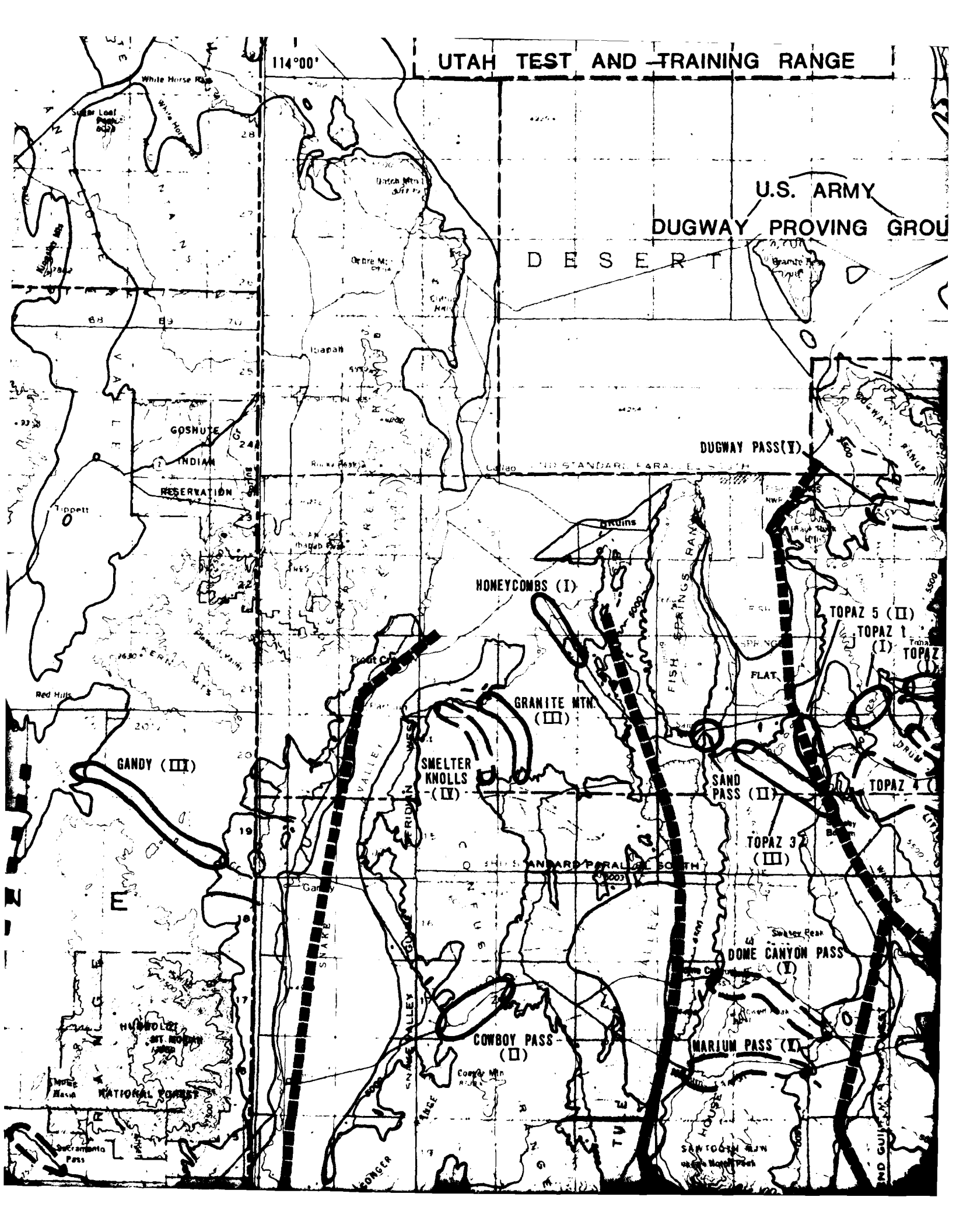
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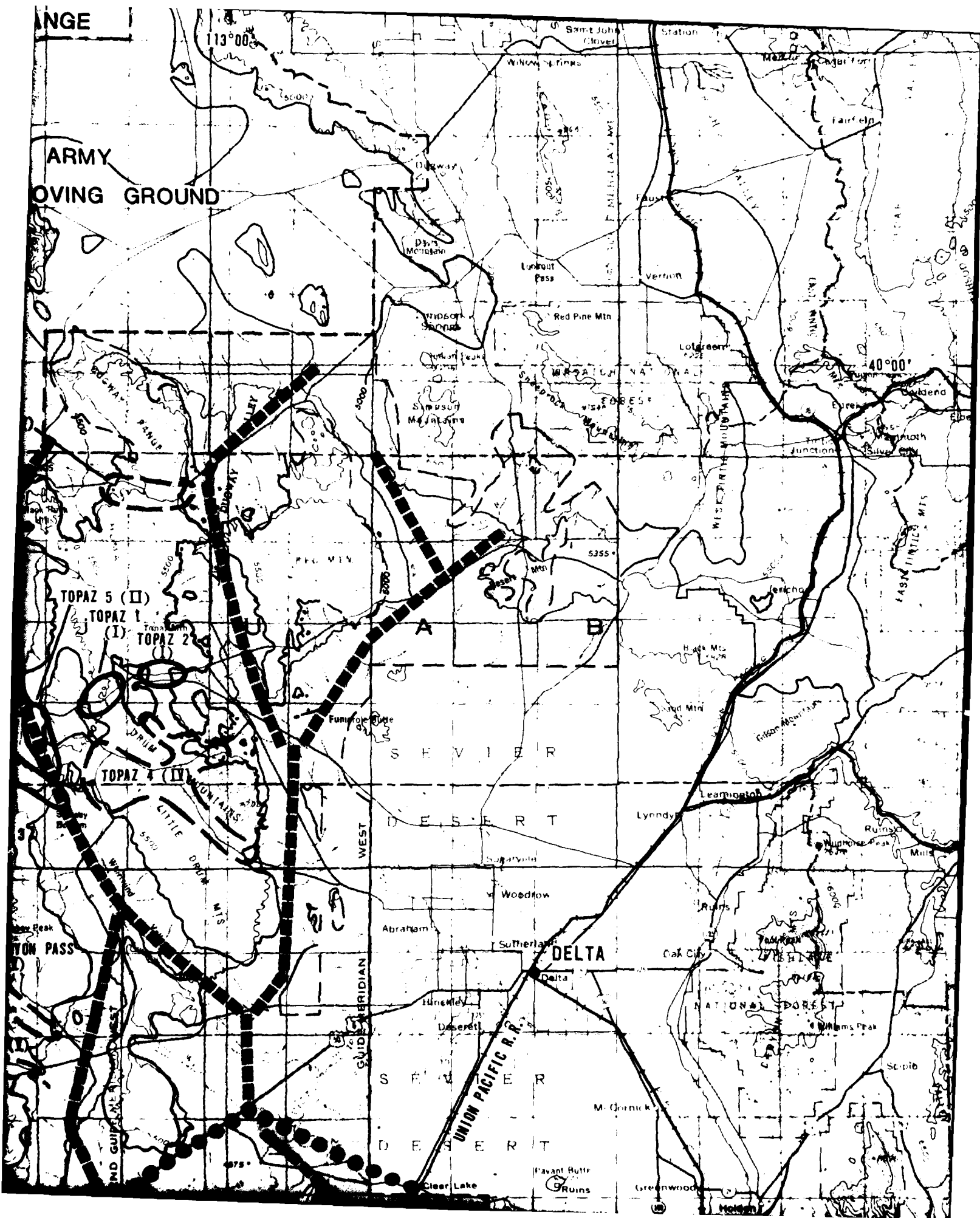
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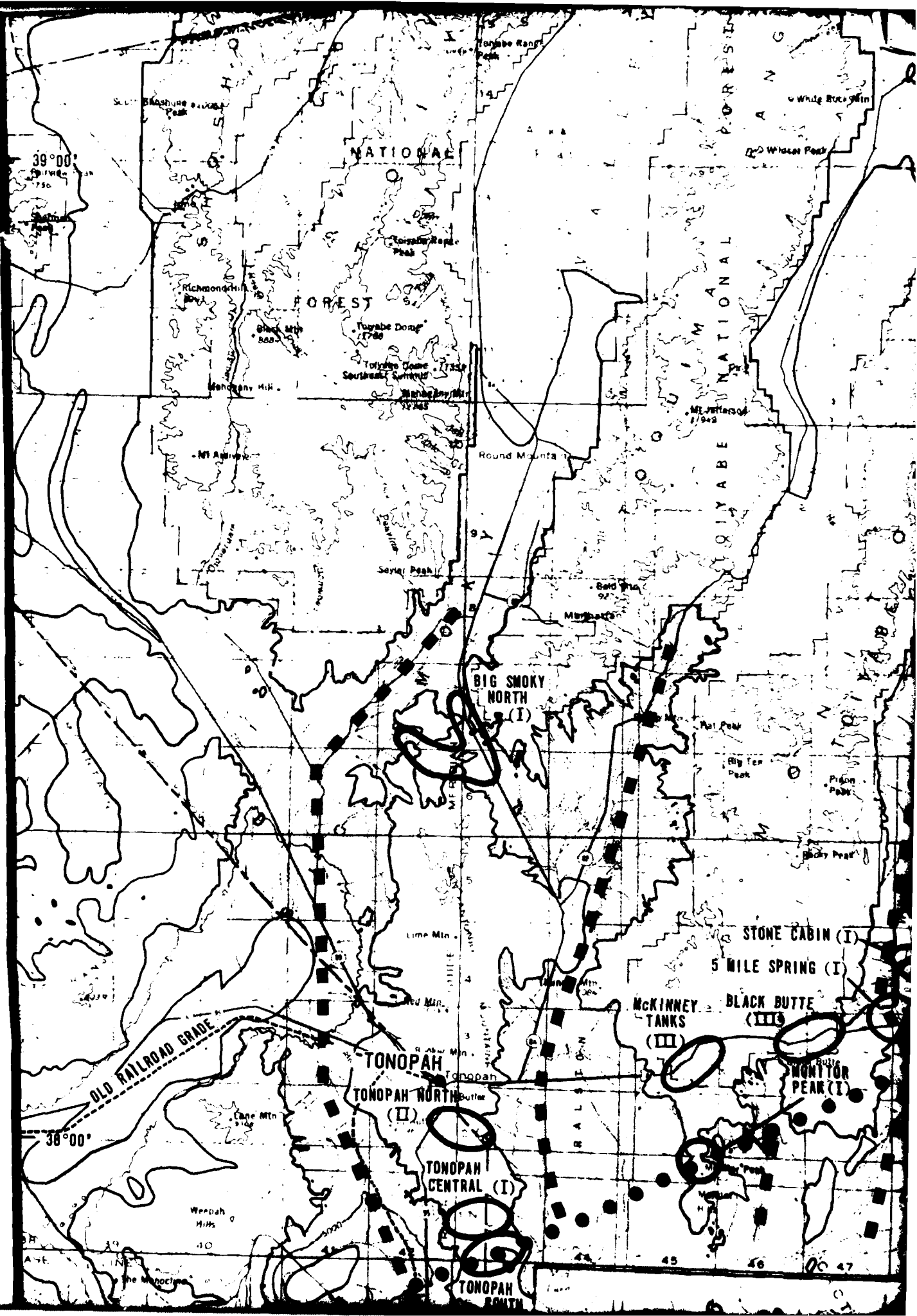
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INDIAN
RESERVATION

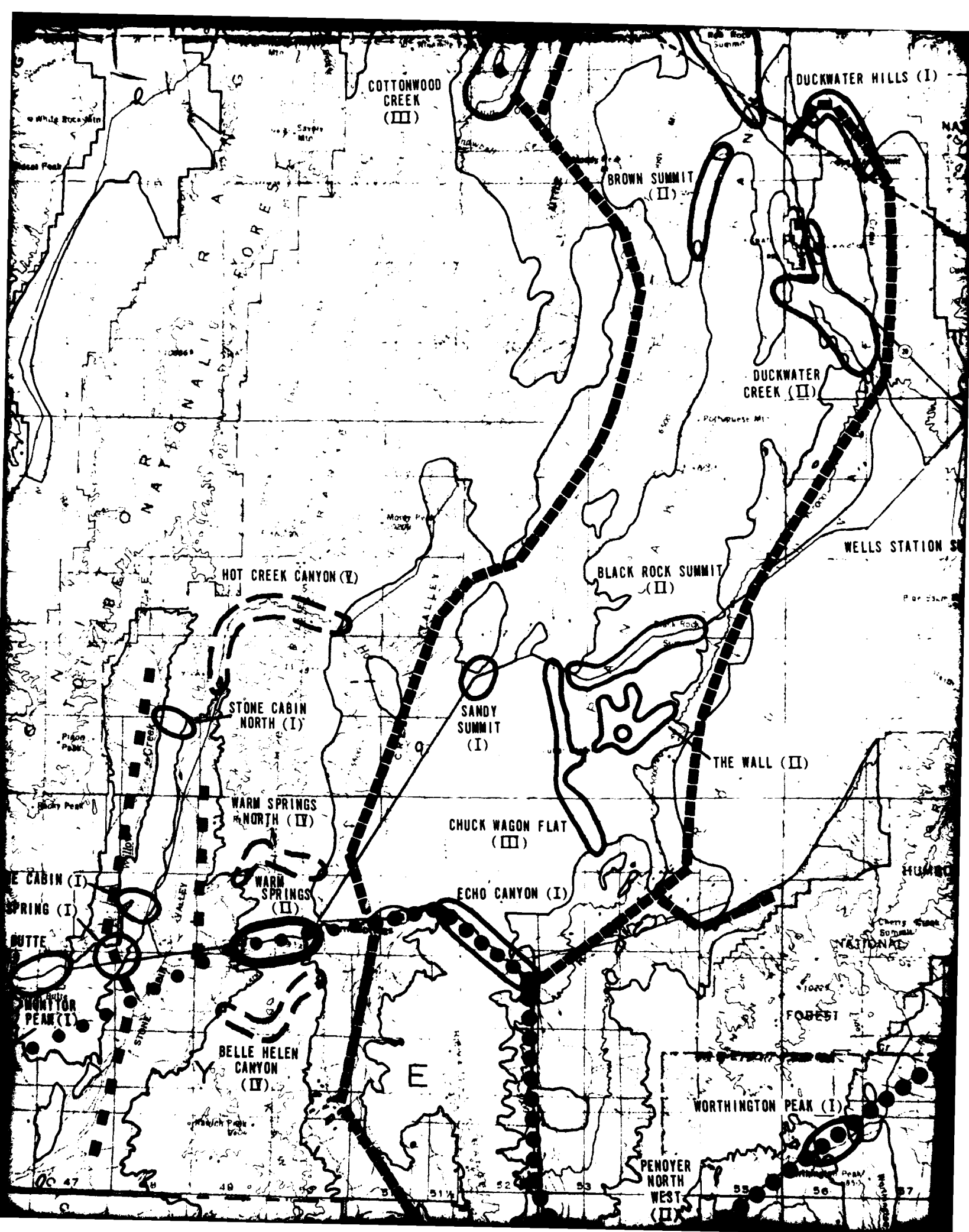
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MOUNTAIN
NATIONAL FOREST

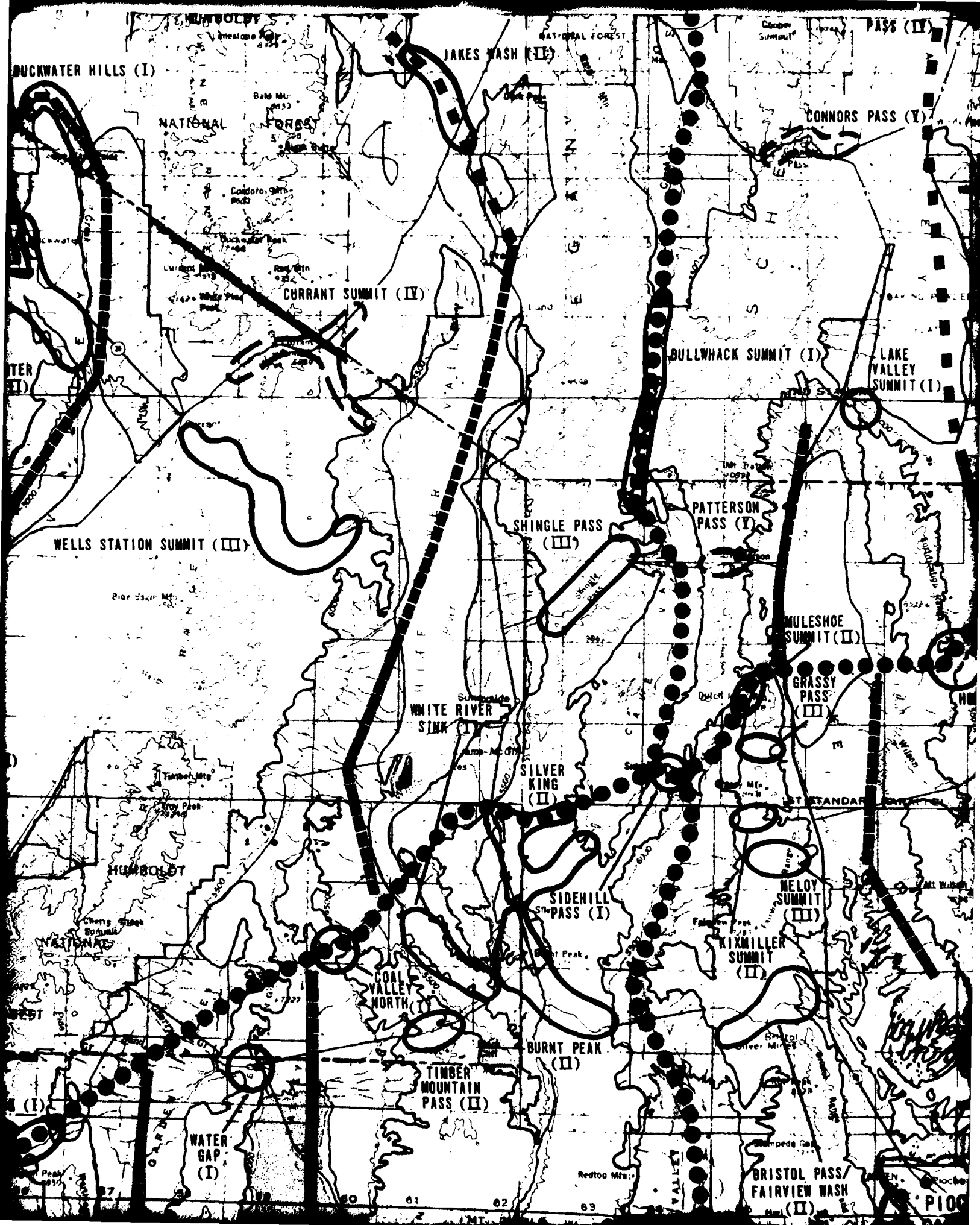
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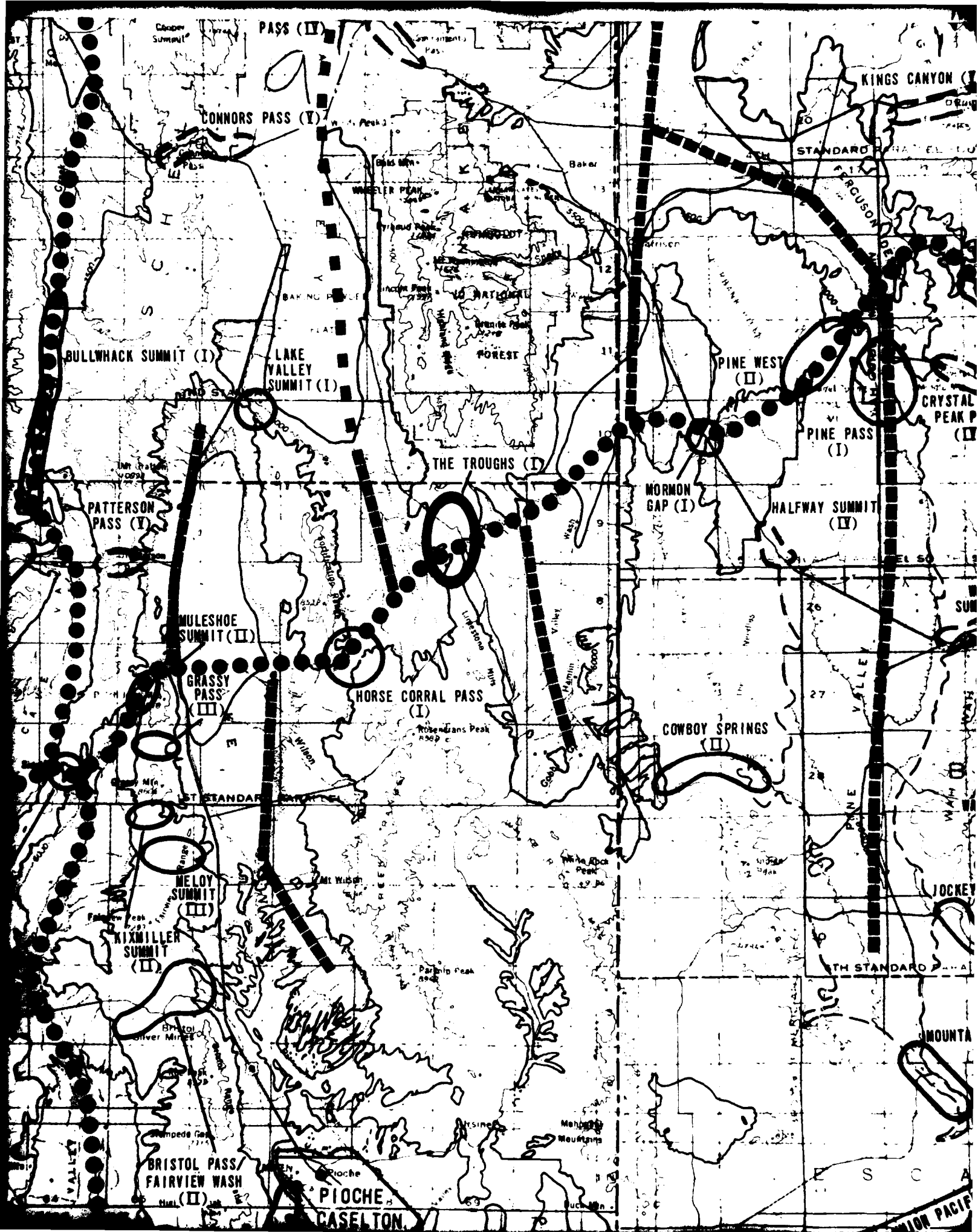


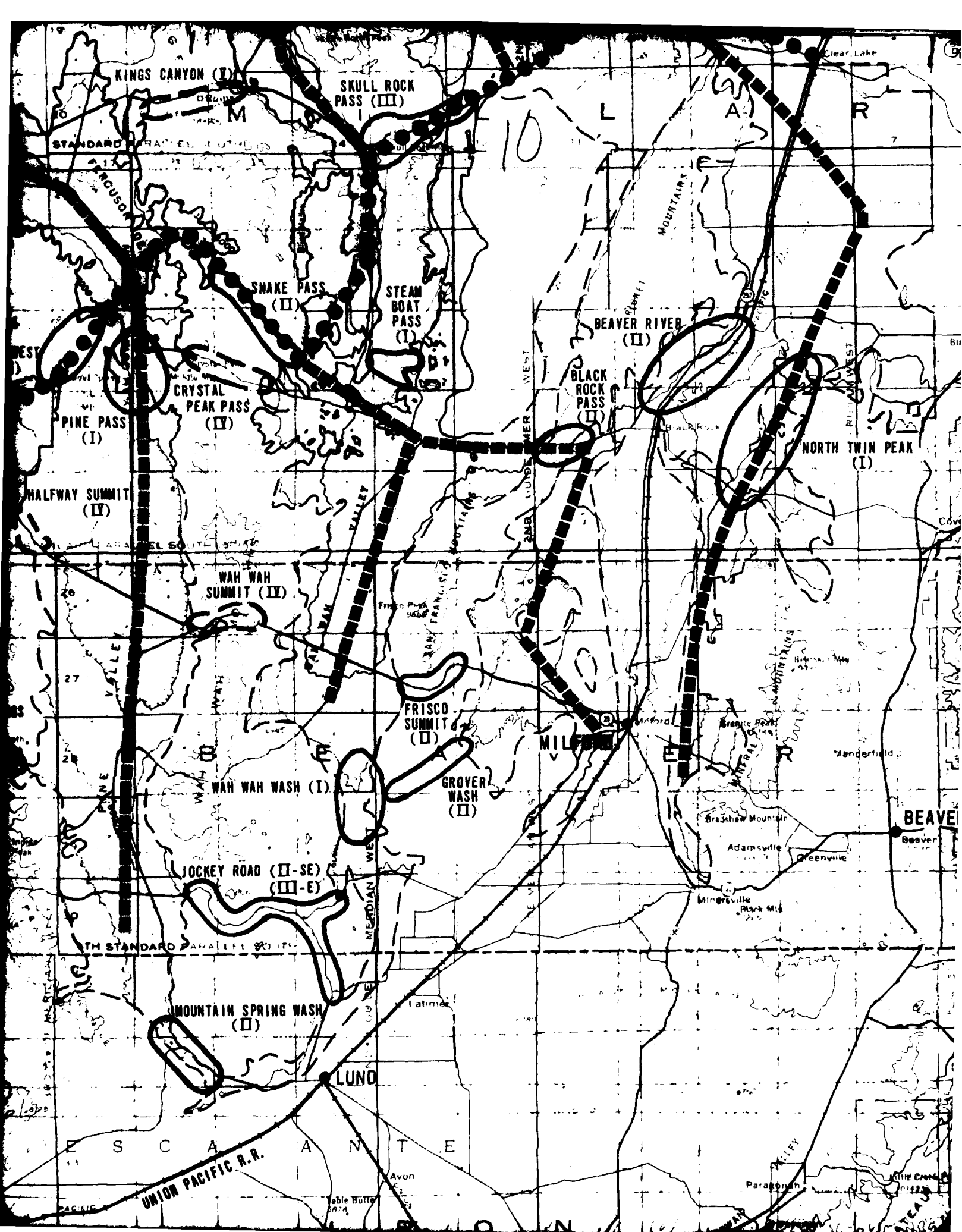


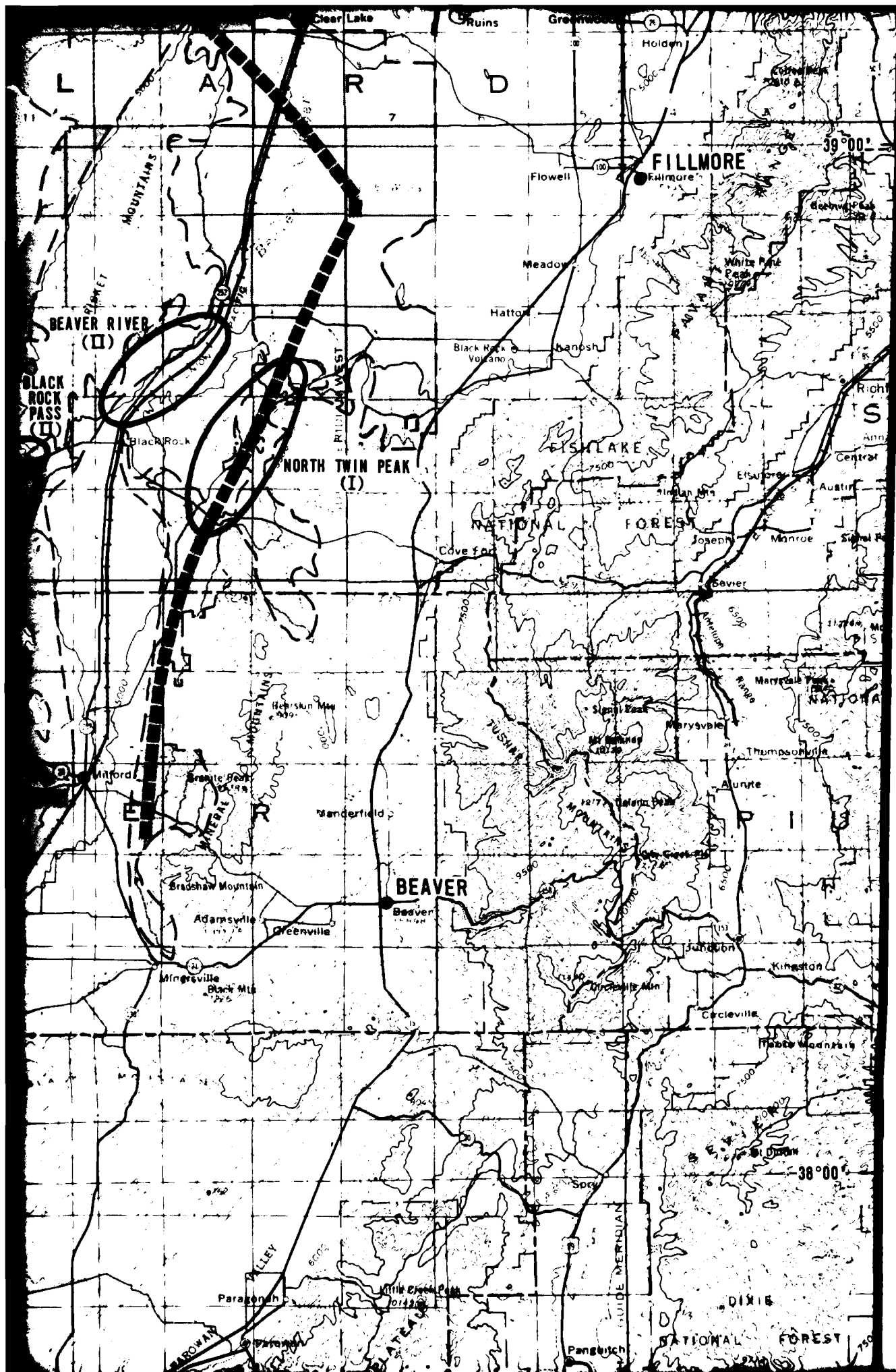


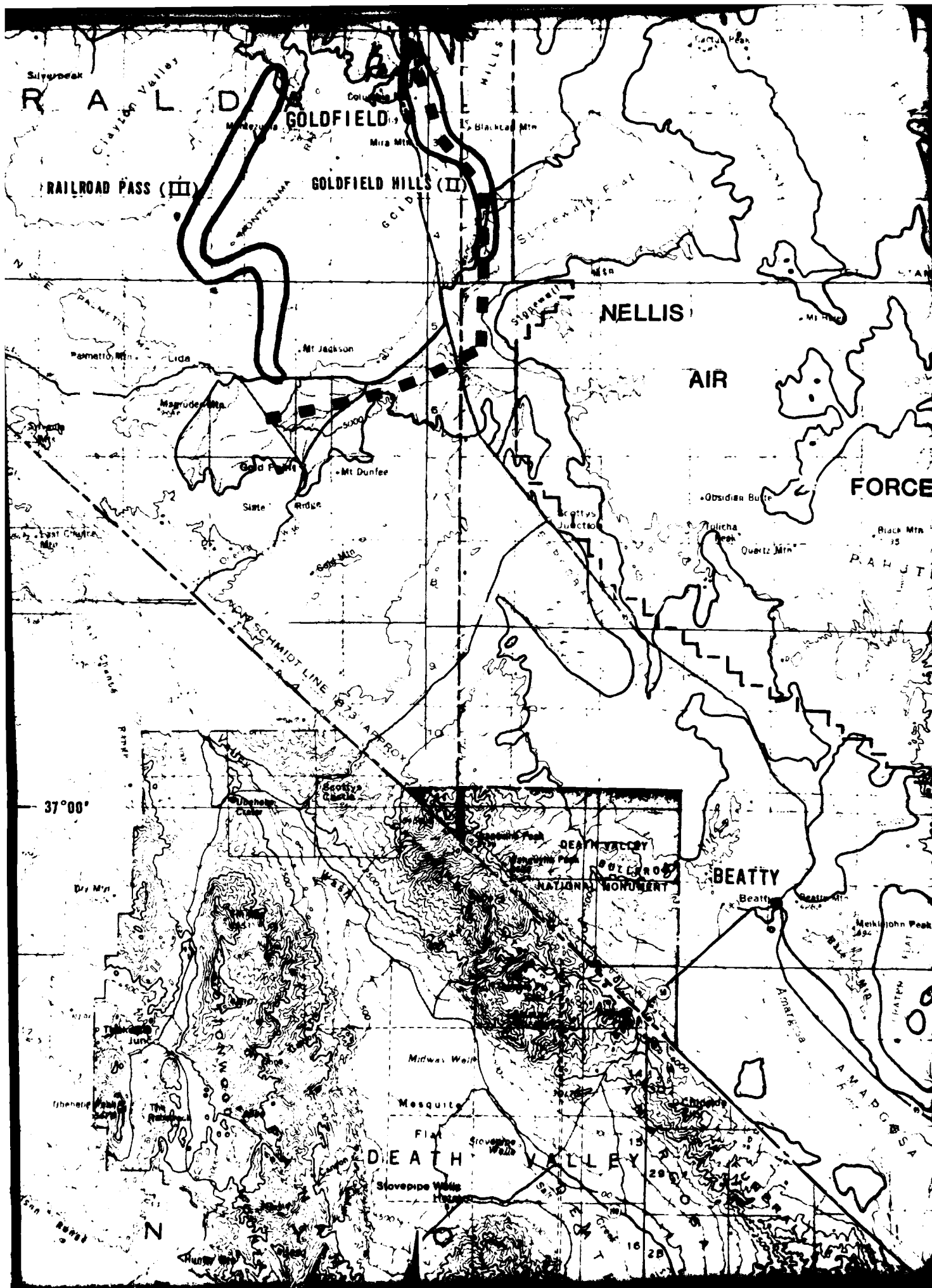


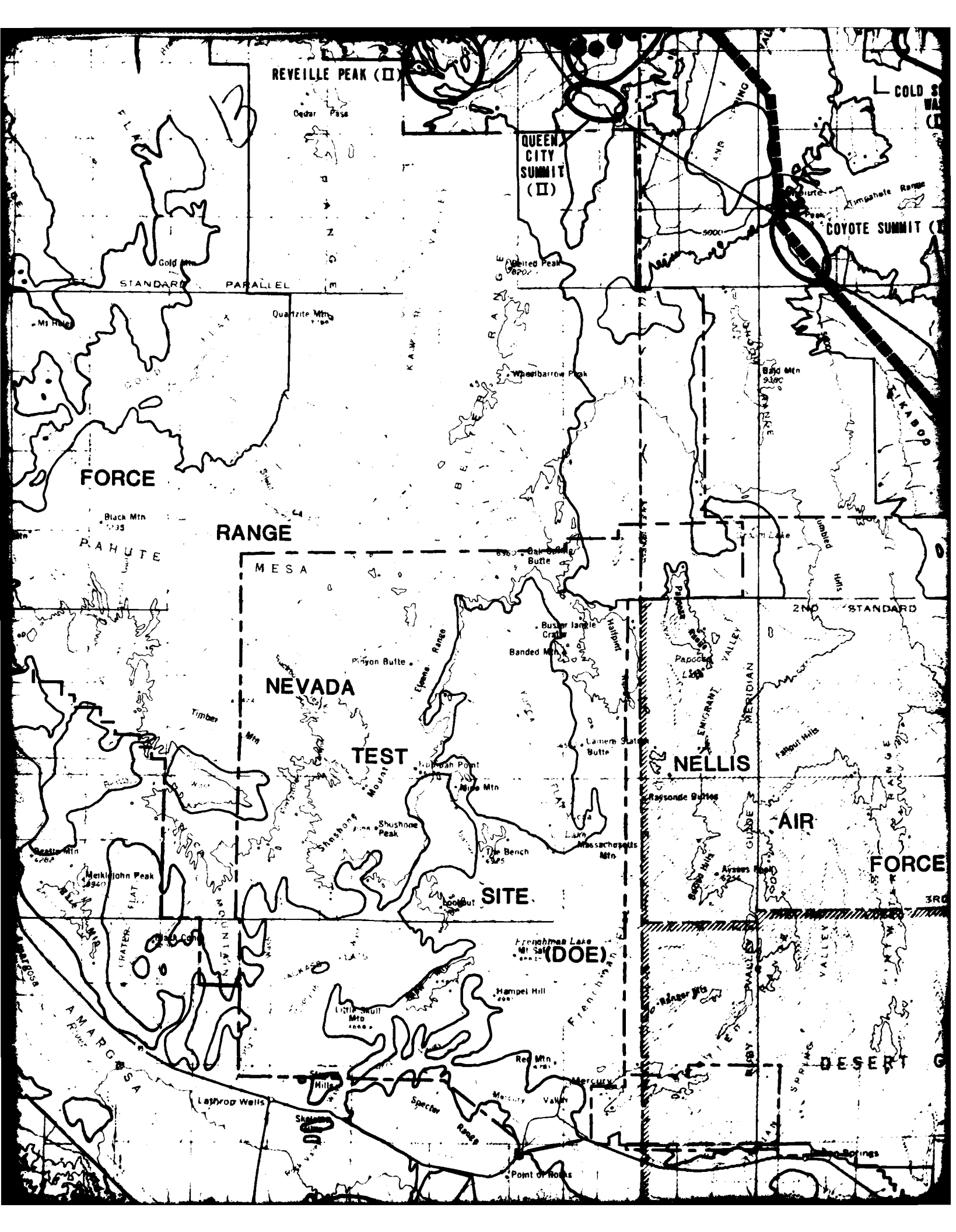


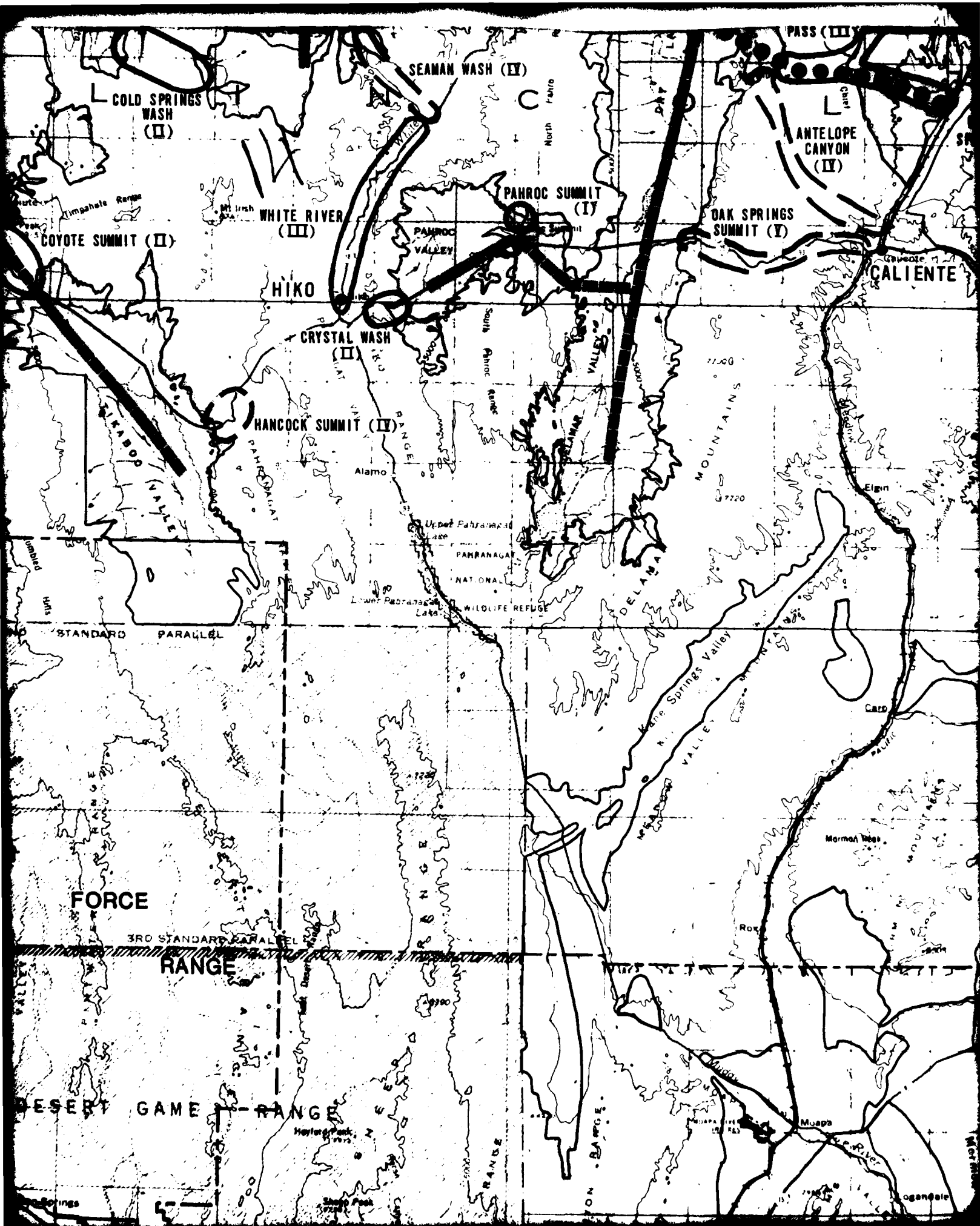


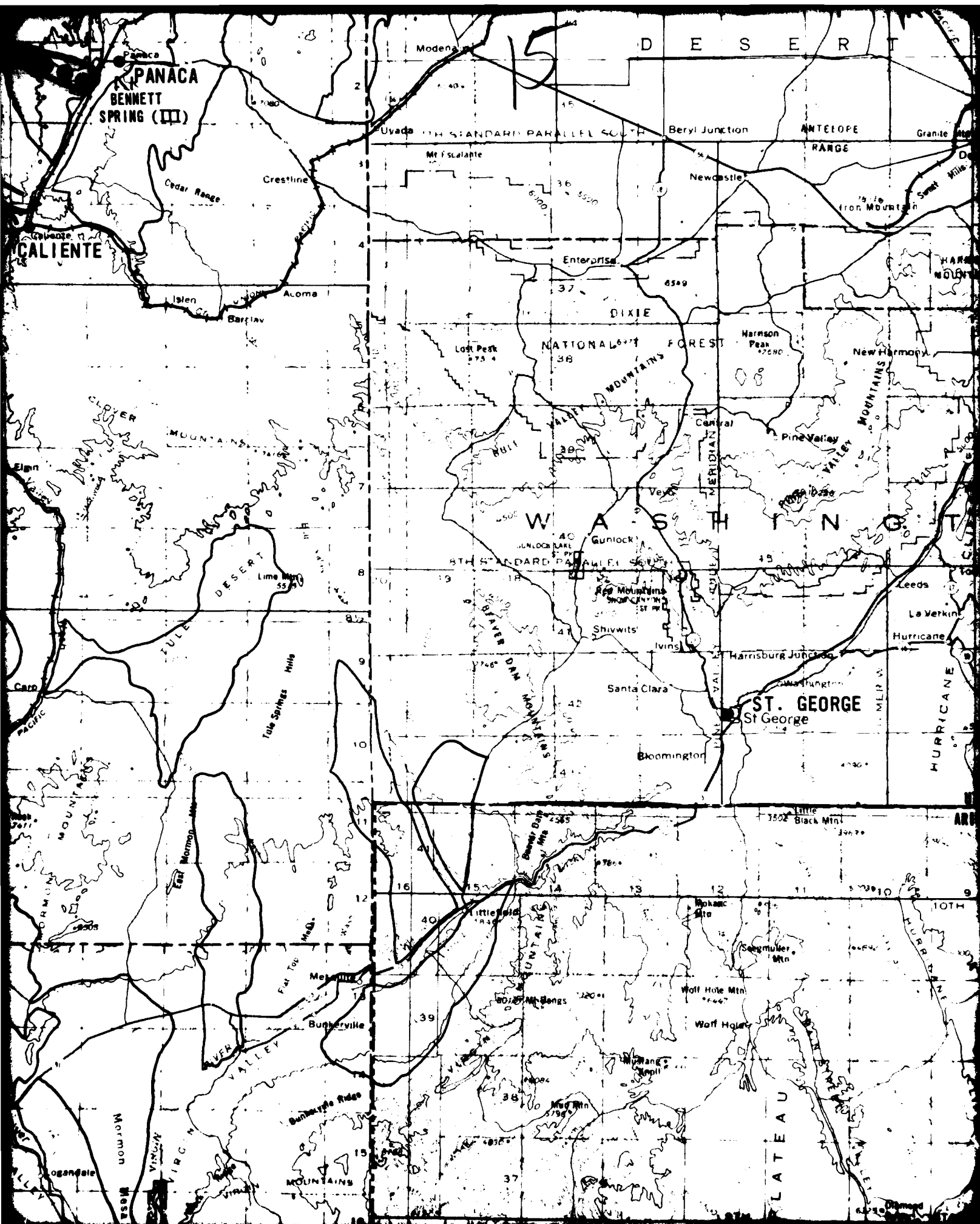


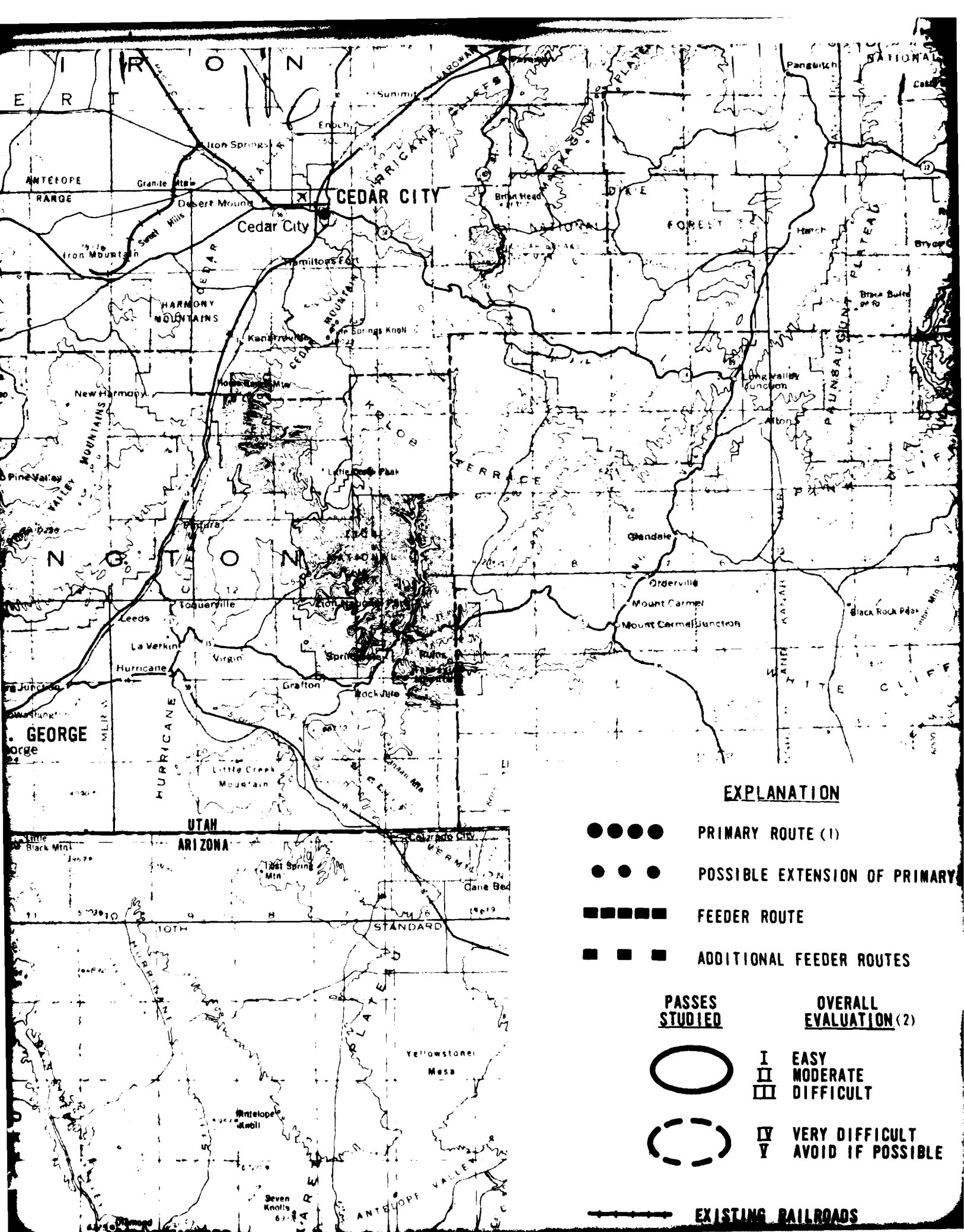




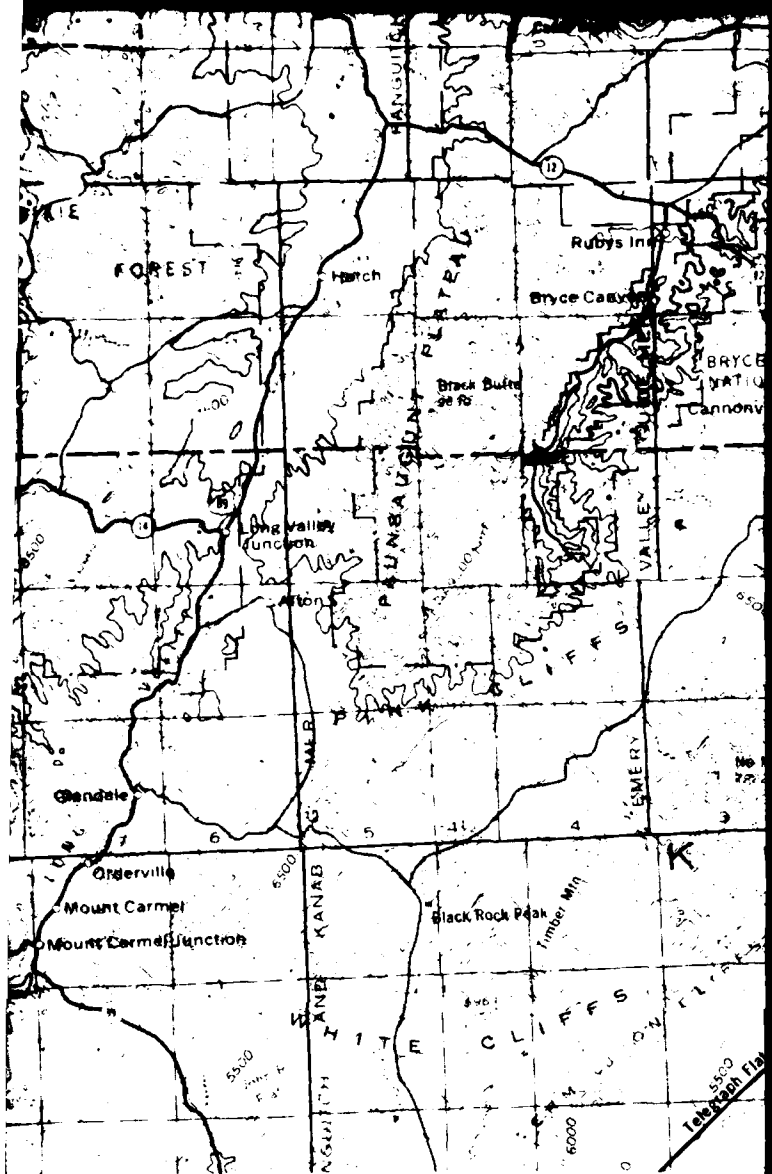








17



EXPLANATION

- ● ● PRIMARY ROUTE (1)
- ● ● POSSIBLE EXTENSION OF PRIMARY ROUTE
- ■ ■ FEEDER ROUTE
- ■ ■ ADDITIONAL FEEDER ROUTES

PASSES STUDIED

OVERALL EVALUATION (2)



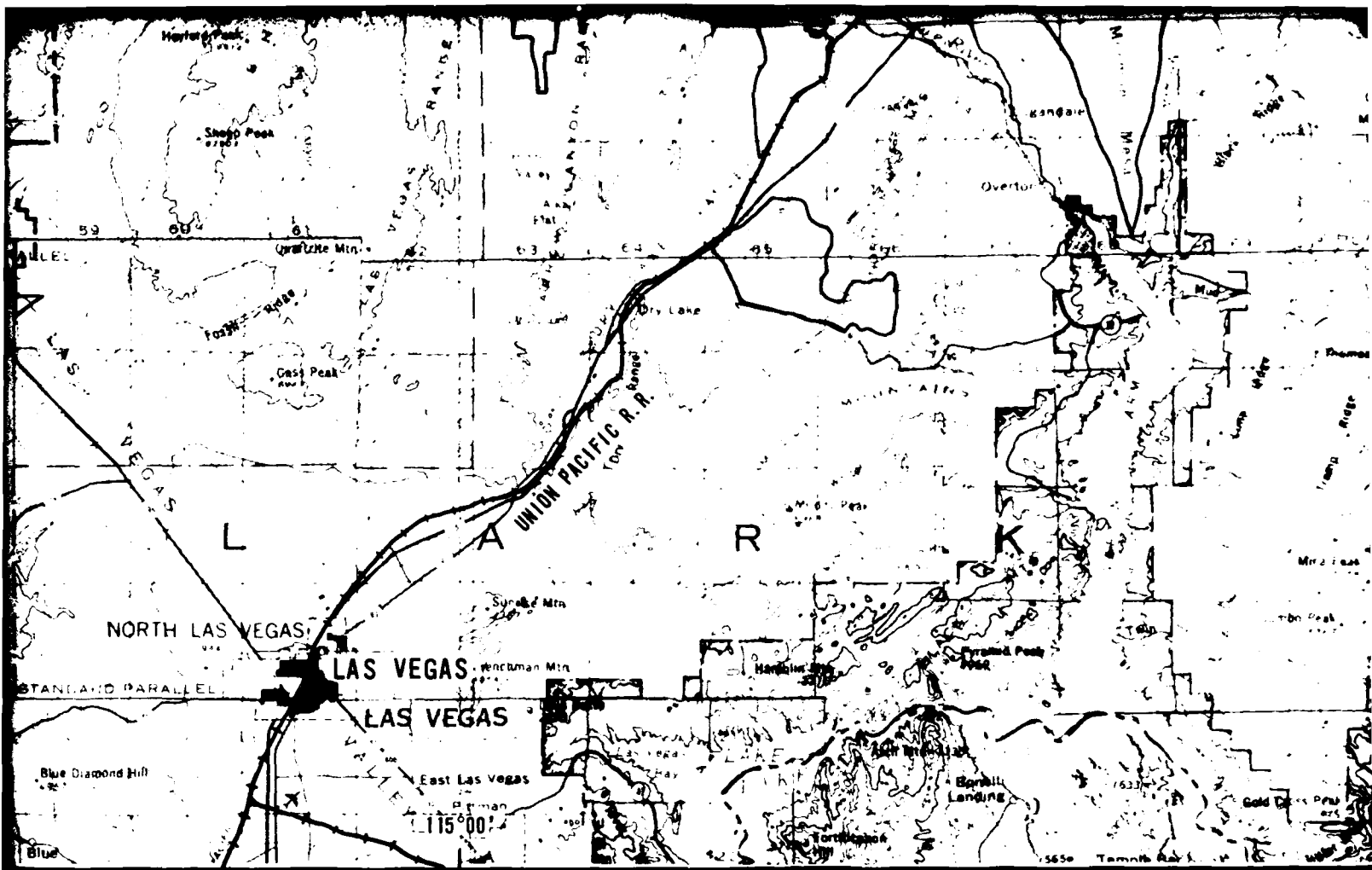
- I EASY
- II MODERATE
- III DIFFICULT

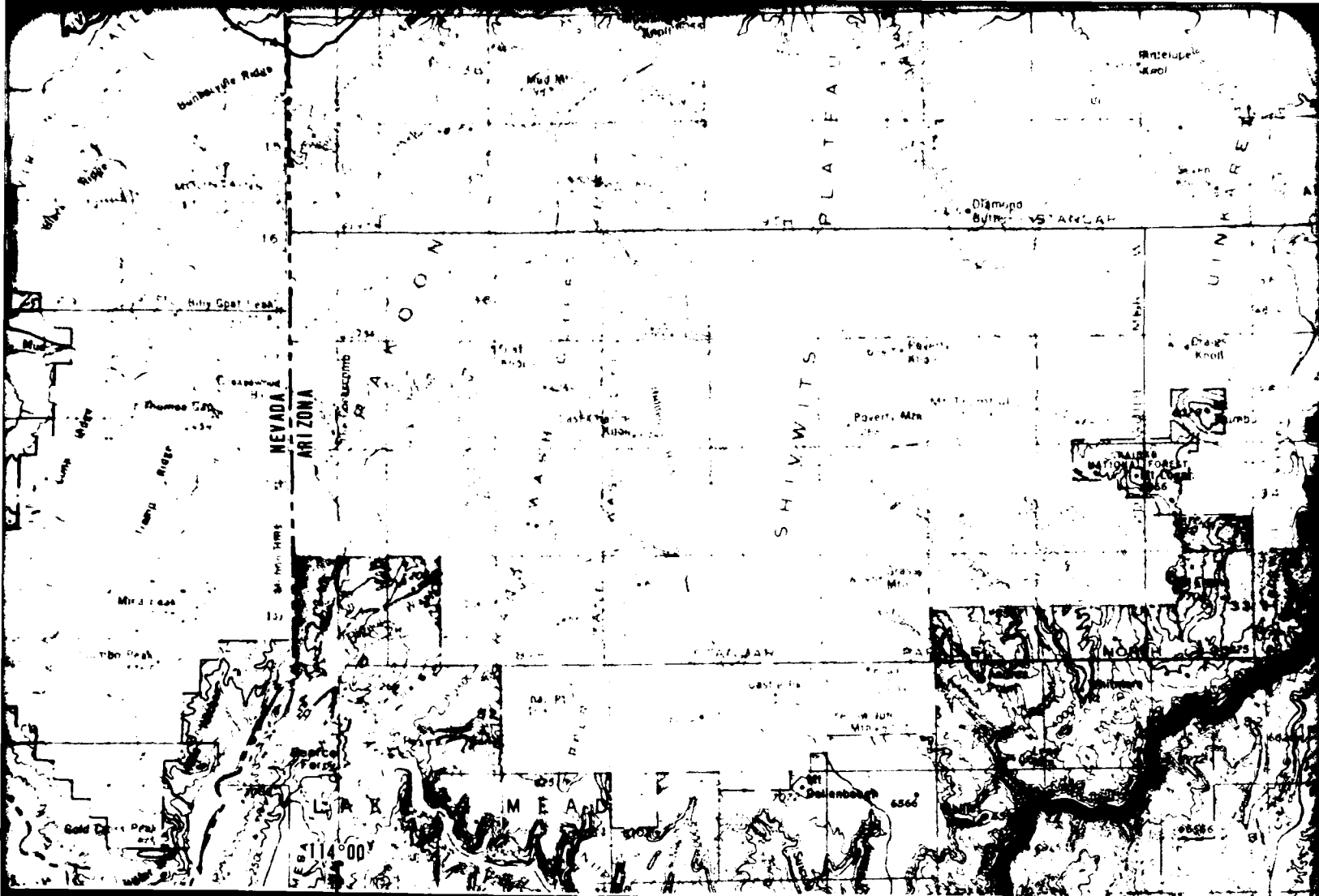


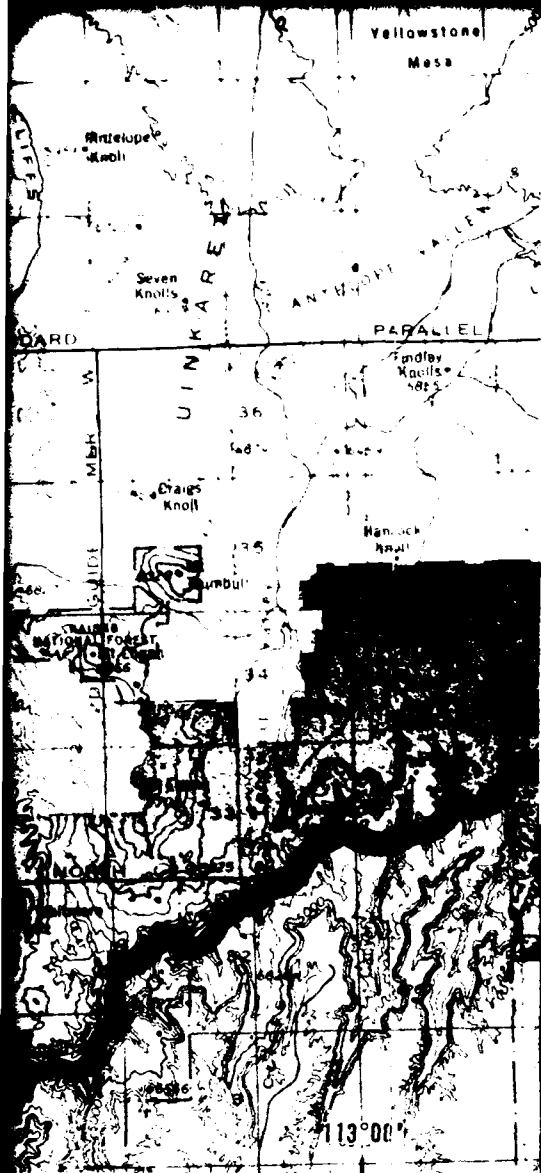
- IV VERY DIFFICULT
- V AVOID IF POSSIBLE

— — — — — EXISTING RAILROADS

■ ■ ■ ■ ■ GEOTECHNICALLY SUITABLE AREA







I EASY
II MODERATE
III DIFFICULT



IV VERY DIFFICULT
V AVOID IF POSSIBLE



EXISTING RAILROADS



GEOTECHNICALLY SUITABLE AREA
WITHIN RAILROAD PASS STUDY



GEOTECHNICALLY SUITABLE AREA
BEYOND LIMITS OF RAILROAD PASS STUDY

- NOTES: (1) ROUTES CONNECTING PASSES ARE NOT
RECOMMENDATIONS OF SPECIFIC ALIGNMENTS.
(2) FOR DESCRIPTION OF OVERALL EVALUATION RANKING
AND CATEGORIES SEE SECTION 4.0.

PROPOSED PRIMARY AND FEEDER RAILROAD ROUTES NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

2

FUGRO NATIONAL, INC.

APPENDIX

RAILROAD PASS EVALUATION SUMMARY

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	FREQUENCY
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								
<u>ANTELOPE CANYON</u> Caliente & Dry Lake, NV.	4 (a)	18	5720	NW-SE	More than Two Sharp Curves	At Pass	Moderate to High	Sever
<u>BEAVER RIVER</u> Black Rock Desert & Milford, UT.	2 (a)	2	4900	NE-SW	Gradual Curves	Railroad, Road & River	Moderate to High	Numer
<u>BELLEHELEN CANYON</u> Reveille & Stone Cabin, NV.	5 (a)	10	7000	NE-W	More than Two Sharp Curves	At Pass	High	Numer
<u>BENNETT PASS</u> Pioche & Dry Lake, NV.	4 (a)	18	6040	NE-SW	Gradual Curves	None	Moderate	Numer
<u>BENNETT SPRING</u> Panaca & Dry Lake, NV.	4 (a)	18	5800	E-W	Gradual Curves	At East End	Moderate to High	Numer
<u>BIG SMOKY NORTH</u> Ralston & Big Smoky, NV.	3 (b)	9	6200	NW-SE	Nearly Straight	None	Moderate	Numer
<u>BLACK BUTTE</u> Stone Cabin & Stone Cabin, NV.	~4 (c)	5	6500	E-W	Gradual Curves	At Pass, Road	Moderate	Numer
<u>BLACK ROCK PASS</u> Milford & Sevier Lake, UT.	4 (b)	3	5215	E-W	Two Sharp Curves	At Pass	Low	Sever
<u>BLACK ROCK SUMMIT</u> Railroad & Big Sand Springs, NV.	4 (a)	3	6260	NE-SW	One or Two Sharp Curves	At Pass, Road	Low	Numer
<u>BRISTOL PASS/FAIRVIEW WASH</u> Lake & Dry Lake, NV.	4 (a)	2	6150	E-W	Gradual Curves	At Pass	Low	Sever
<u>BROWN SUMMIT</u> Railroad & Big Sand Springs, NV.	4 (a)	8	6800	NE-SW	One or Two Sharp Curves	At Pass	Low to Moderate	Numer
<u>BULLWHACK SUMMIT</u> Steptoe & Cave, NV.	4 (a)	20	7240	N-S	Gradual Curves	None	Low	Sever
<u>BURNT PEAK</u> Dry Lake & White River, NV.	4 (a)	8	5540	E-W	Gradual Curves	At Pass	Moderate	Numer
<u>CHUCK WAGON FLAT</u> Railroad & Big Sand Springs, NV.	4 (a)	11	5860	N-S	Gradual Curves	None	Low to Moderate	Numer
<u>COAL VALLEY NORTH</u> White River & Coal, NV.	~1 (c)	4	5270	NE-SW	Nearly Straight	None	Low	Sever

NOTES: (a) DATA ESTIMATED FROM 7½" (1:24,000) TOPOGRAPHIC MAP COVERAGE
 (b) DATA ESTIMATED FROM 15" (1:62,500) TOPOGRAPHIC MAP COVERAGE
 (c) DATA ESTIMATED FROM 2" (1:250,000) TOPOGRAPHIC MAP COVERAGE

(d) OVERALL EVALUATIONS

I - EASY

II - MODERATE

III - DIFFICULT

IV - VERY DIFFICULT

V - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
 RANKING AND CATEGORIES, SEE SECTION 4.0

FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
	FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
Moderate to High	Several	More than one	Moderate to Difficult	Moderate to Heavy	IV	Unpaved road from resistant rock constriction to U S Hwy 93 on east end of alignment. Sixty-nine k v transmission line cuts at a right angle at northwest end of alignment.
Moderate to High	Numerous	More than one	Moderate	Moderate	II	State Hwy 257. Union Pacific Railroad. Beaver River. Some private property near southern end.
High	Numerous	More than one	Moderate to Difficult	Heavy	IV	Unpaved road. Small amount of private property south center of alignment. Road is between IWIU NV-060-019 & 120 & 130. Alignment is alternate to Warm Springs.
Moderate	Numerous	None	Moderate	Moderate to Heavy	III	Unpaved road. Sixty-nine k v transmission line.
Moderate to High	Numerous	More than one	Moderate	Moderate to Heavy	III	Unpaved road. Sixty-nine k v transmission line from summit to the west. Private property at eastern access.
Moderate	Numerous	More than one	Moderate	Light	I	State Hwy 8A unpaved road. Utility line crosses north end of 8A and west end of unpaved road.
Moderate	Numerous	One	Moderate	Heavy	III	U S Hwy 6. Utility line alignment totally within Toiyabe National Forest.
Low	Several	One	Moderate	Moderate	II	Unpaved road. Locate alignment to avoid resistant rock outcrops.
Low	Numerous	None	Moderate to Difficult	Moderate	II	U S Hwy 6. Utility line. Road runs between IWIU NV-060-174 & 176, 183.
Low	Several	None	Moderate	Moderate to Heavy	II	Unpaved road. Bristol Pass preferred route. 40% cross slope at summit, rather than alternate to north.
Low to Moderate	Numerous	None	Moderate	Moderate	II	Unpaved road. Cross slopes at constriction. Some heavy grading at north end. Road between IWIU NV 060 040 153 & 155.
Low	Several	None	Easy	Light	I	Unpaved road. 4% grade two miles north of summit. Some private property near southern access.
Moderate	Numerous	More than one	Moderate	Moderate to Heavy	II	Unpaved road. Alternate north or south exits into White River Valley at west end.
Low to Moderate	Numerous	None	Moderate to Difficult	Moderate	III	Unpaved road. Some resistant rock outcrops. Road between IWIU NV-060-142, 162 & 163.
Low	Several	None	Easy	Light	I	Unpaved road. Some private property in general area. Southeast of road is IWIU NV-040-241A.

(e) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL ALIGNMENT UNLESS OTHERWISE STATED

• BUREAU OF LAND MANAGEMENT (BLM) OWNERSHIP UNLESS OTHERWISE STATED.

• ALL INITIAL WILDERNESS INVENTORY UNITS (IWIU) LISTED ARE APPROVED (AUG. 1979) FOR FURTHER FIELD STUDY AS POTENTIAL WILDERNESS AREAS BY BLM

RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS0

TABLE
A-1
1 OF 7

FURRO NATIONAL, INC.

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	DRAIN CROSS
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								FREQUENCY
COLD SPRINGS WASH Coal & Garden, NV.	~4 (c)	5	6300	E-NW	One to Two Sharp Curves	At Pass	Moderate	Numerous
CONNORS PASS Spring & Steptoe, NV.	6 (b)	7	7720	E-W	More than Two Sharp Curves	Entire Route	Moderate	Numerous
COTTONWOOD CREEK Little Smoky & Antelope, NV.	4 (b)	8	7050	N-SE	Gradual Curves	At SE	Moderate to High	Numerous
COWBOY PASS Tule & Snake, UT.	4 (b)	4	5720	NE-SW	Gradual Curves	At Pass	Moderate	Numerous
COWBOY SPRINGS Pine & Hamlin, UT.	3 (a)	10	7040	E-W	Gradual Curves	At East	Moderate	Numerous
COYOTE SUMMIT Tikaboo & Penoyer (Sand Spring), NV.	4 (b)	7	5600	NE-SW	Gradual Curves	None	Moderate	Numerous
CRYSTAL PEAK PASS Tule & Snake, UT.	5 (b)	2	6300	E-W	More than Two Sharp Curves	Entire Route	Moderate	Numerous
CRYSTAL WASH Pahroc & Pahrnanagat, NV.	4 (a)	4	4000	E-W	Gradual Curves	At Pass, Road	Moderate	Several
CURRENT SUMMIT White River & Railroad, NV.	4 (b)	14	7000	E-W	More than Two sharp Curves	Entire Route	Moderate	Numerous
DOMO CANYON PASS Whirlwind & Tule, UT.	20 (a)	4	6680	E-W	More than Two Sharp Curves	Entire Route	Moderate	Numerous
DUCKWATER CREEK Railroad & Railroad, NV.	4 (b)	8	5600	NW-SE	Gradual Curves	Farms, Creek & Road	Moderate	Several
DUCKWATER HILLS Railroad & Railroad, NV.	2 (b)	4	5960	NE-SW	Gradual Curves	None	Low to Moderate	Numerous
DUGWAY PASS Fish Springs & Dugway, UT.	10 (a)	3	5410	E-W	More than Two Sharp Curves	Entire Route	Moderate	Numerous
ECHO CANYON Railroad & Reveille, NV.	0.5 (a)	7	5100	NW-SE	Nearly Straight	Lake & Road	Low	Several
FIVE MILE SPRING Stone Cabin East & Stone Cabin West, NV.	2 (c)	2	5700	E-W	Nearly Straight	None	Low	Several

NOTES: (a) DATA ESTIMATED FROM 7½' (1:24,000) TOPOGRAPHIC MAP COVERAGE
(b) DATA ESTIMATED FROM 15' (1:62,500) TOPOGRAPHIC MAP COVERAGE
(c) DATA ESTIMATED FROM 2' (1:250,000) TOPOGRAPHIC MAP COVERAGE

(d) OVERALL EVALUATIONS

(e)

I - EASY

II - MODERATE

III - DIFFICULT

IV - VERY DIFFICULT

V - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
RANKING AND CATEGORIES, SEE SECTION 4.0

FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
	FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
Moderate	Numerous	More than one	Moderate	Moderate	II	Unpaved road. North of road is IWIU NV-040-243
Moderate	Numerous	More than one	Difficult	Heavy	I	U.S. Hwy 50. Three quarters in Humbolt National Forest in east; one quarter is BLM in west
Moderate to High	Numerous	More than one	Moderate	Moderate to Heavy	III	Heavy cross drainage Very rough terrain. Two alternate routes to south.
Moderate	Numerous	None	Moderate	Moderate	II	Unpaved road. Requires relocating existing road
Moderate	Numerous	One	Moderate	Moderate	II	Unpaved road. Best east approach along axial wash. North of pass is IWIU UT-040-104
Moderate	Numerous	None	Moderate	Moderate	II	State Hwy 25
Moderate	Numerous	One or more	Moderate to Difficult	Heavy	IV	Unpaved road. South of road is IWIU UT-50-073.
Moderate	Several	One	Moderate	Moderate to Heavy	II	U.S. Hwy 93. Utility line. South of road is IWIU NV-050-0132.
Moderate	Numerous	More than one	Moderate to Difficult	Heavy	IV	U.S. Hwy 6. One third private property in west. Two thirds Humbolt National Forest in east.
Moderate	Numerous	More than one	Difficult	Heavy	I	Unpaved road. 8% grade on approaches. Road between IWIU UT-050-061 & 077
Moderate	Several	One	Moderate	Moderate	II	State Hwy 20. On or near Indian Reservation and private property. Southwest of area is IWIU NV-040-155.
Low to Moderate	Numerous	None	Moderate	Light to Moderate	I	Unpaved road.
Moderate	Numerous	More than one	Moderate to Difficult	Very Heavy	I	Unpaved road. Road between IWIU UT-050-113 & 130A
Low	Several	None	Moderate	Light to Heavy	I	U.S. Hwy 25. Large cut for 0.1 mile at constriction (intalus slope). Some private property near northside at northwest end. Reservoir at southern end Road between IWIU NV-060-132 & 142.
Low	Several	None	Easy	Light	I	South end of alignment terminates at U.S. Hwy 6. Half of alignment is private property on north end and half is BLM on south.

(e) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL
ALIGNMENT UNLESS OTHERWISE STATED

• BUREAU OF LAND MANAGEMENT (BLM) OWNERSHIP UNLESS
OTHERWISE STATED.

• ALL INITIAL WILDERNESS INVENTORY UNITS (IWIU) LISTED
ARE APPROVED (AUG. 1979) FOR FURTHER FIELD STUDY
AS POTENTIAL WILDERNESS AREAS BY BLM

RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS0

TABLE
A-1
2 OF 7

FUSRO NATIONAL, INC.

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	GOOD P.ENTIAL	FREQUEN
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								
<u>FRISCO SUMMIT</u> Milford & Wah Wah, UT.	4 (b)	4	6460	E-W	Gradual Curves	At Pass, Road	Moderate to high	Numerous
<u>GANDY</u> Snake & Spring, NV.	3 (c)	25	6900	E-W	Gradual Curves	At Pass, Mining Claims	Moderate	Numerous
<u>GOLDFIELD HILLS</u> Big Smoky & Stonewall Flat, NV.	3 (b)	8	5600	N-S	Gradual Curves	Mines at Summit	Low to Moderate	Numerous
<u>GRANITE MOUNTAIN</u> Tule & Snake, UT.	3 (b)	6	5440	N-S	Nearly Straight	None	Moderate	Numerous
<u>GRASSY PASS</u> Lake & Muleshoe, NV.	4 (a)	5	6650	E-W	One or Two Sharp Curves	At Pass	Low to Moderate	Severely
<u>GROVER WASH</u> Milford & Wah Wah, UT.	4 (b)	11	6280	E-W	Gradual Curves	None	Moderate	Numerous
<u>HALFWAY SUMMIT</u> Pine & Snake, UT.	8 (a)	2	6250	NE-SW	One or Two Sharp Curves	At Pass, Road	Moderate	Severely
<u>HANCOCK SUMMIT</u> Pahranagat & Tikaboo, NV.	~6 (c)	7	5800	NE-NW	More than Two Sharp Curves	At Pass, Road	Low	Numerous
<u>HONEY COMBS</u> Tule & Snake, UT.	3 (b)	2.5	5180	NW-SE	Nearly Straight	None	Low	Numerous
<u>HORSE CORRAL PASS</u> Spring & Lake, NV.	2 (a)	6	6380	NE-SW	Gradual Curves	None	Moderate	Severely
<u>HOT CREEK CANYON</u> Hot Creek & Stone Cabin, NV.	4 (b)	9	6200	E-W	More than Two Sharp Curves	Entire Route	High	Severely
<u>JAKES WASH</u> Jakes & White River, NV.	1.5 (b)	7	6440	NW-SE	Gradual Curves	At Pass	Moderate	Numerous
<u>JOKEY ROAD</u> Escalante & Pine, UT.	4 (a)	18	6870	E-W or SE-W	One or Two Sharp Curves	At East	Low to Moderate	Severely
<u>KINGS CANYON</u> Tule & Snake, UT.	6 (b)	9	6280	E-W	More than Two Sharp Curves	Entire Route	Moderate to High	Numerous
<u>KIX MILLER SUMMIT</u> Lake & Muleshoe, NV.	4 (a)	4	6600	E-W	Gradual Curves	None	Moderate	Numerous

NOTES: (a) DATA ESTIMATED FROM 7½" (1:24,000) TOPOGRAPHIC MAP COVERAGE
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 (c) DATA ESTIMATED FROM 2" (1:250,000) TOPOGRAPHIC MAP COVERAGE

(d) OVERALL EVALUATIONS

- I - EASY
 □ - MODERATE
 ■ - DIFFICULT
 X - VERY DIFFICULT
 T - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
 RANKING AND CATEGORIES, SEE SECTION 4.0

FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
	FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
Moderate to high	Numerous	One	Moderate to Difficult	Moderate	II	State Hwy 21. Rock cuts at east approach. Use railroad grade. Some private property in general area.
Moderate	Numerous	More than one	Moderate to Difficult	Moderate to Heavy	III	Unpaved road. Road between IWIU NV-040-079, 079B, 079C & NV-040-082.
Low to Moderate	Numerous	None	Easy	Light	II	Unpaved roads. Generally follows old railroad grade. Crosses numerous mining claims at summit. South half of alignment through IWIU NV-050-0345.
Moderate	Numerous	One	Moderate	Moderate to Heavy	III	Unpaved road.
Low to Moderate	Several	None	Moderate	Moderate to Heavy	III	Unpaved road.
Moderate	Numerous	One	Easy	Light to Moderate	II	Unpaved road.
Moderate	Several	More than one	Moderate to Difficult	Moderate to Heavy	IV	State Hwy 21. Is inside Desert Range Experimental Farm. Alternate is four miles south with four percent grade, but poor alignment.
Low	Numerous	One	Moderate to Difficult	Heavy	IV	State Hwy 25. South of road is IWIU NV-050-0131.
Low	Numerous	None	Moderate	Light	I	Unpaved road. South end of alignment, north side of road is IWIU UT-050-127.
Moderate	Several	None	Moderate	Light to Moderate	I	Unpaved road. Just north of pass is IWIU NV-040-177.
High	Several	More than one	Difficult	Heavy	V	Unpaved road. East half private property with farms/ranches. West half BLM. Road between IWIU NV-60-079 & 089. On west side of western access could have contact with NV-060-078.
Moderate	Numerous	One or Two	Easy to Moderate	Moderate	II	Unpaved road. Pass between IWIU NV-040-130A.
Low to Moderate	Several	None	Easy	Moderate	II to SE III to E	Unpaved road. Southeast to west route preferable.
Moderate to High	Numerous	More than one	Difficult	Heavy	V	U.S. Hwy 6 & 50. Utility line north of hwy. South of hwy is IWIU UT-050-070.
Moderate	Numerous	None	Moderate	Moderate	II	Unpaved road. One quarter private property at east end. Three-quarters BLM at west side.

(e) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL ALIGNMENT UNLESS OTHERWISE STATED

• BUREAU OF LAND MANAGEMENT (BLM) OWNERSHIP UNLESS OTHERWISE STATED

• ALL INITIAL WILDERNESS INVENTORY UNITS (IWIU) LISTED ARE APPROVED (AUG., 1970) FOR FURTHER FIELD STUDY AS POTENTIAL WILDERNESS AREAS BY BLM

RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS0

TABLE
A 1
3 of 7

FURRO NATIONAL, INC.

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	DE CR
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								FREQUENCY
LAKE VALLEY SUMMIT Spring & Lake, NV.	4 (a)	1	6140	NE-SW	Gradual Curves	Road & Utilities	Low	Severe
MARJUM PASS Whirlwind & Tule, UT.	8 (a)	6	6220	E-W	More than Two Sharp Curves	Entire Route	Moderate	Numerous
McKINNEY TANKS Stone Cabin & Ralston, NV.	~4 (c)	5	6200	E-W	Broad Curves	At Pass, Road	Moderate	Numerous
MELOY SUMMIT Lake & Muleshoe, NV.	4 (a)	6	6800	E-W	One or Two Sharp Curves	At Pass	Moderate	Numerous
MONITOR PEAK Stone Cabin & Ralston, NV.	~1 (c)	2	5400	E-W	Nearly Straight	None	Low	Few
MORMON GAP Snake & Hamlin, UT.	2 (a)	1	5700	NW-SE	Gradual Curves	At Pass, Road	Moderate	Severe
MOUNTAIN SPRING WASH Pine & Escalante, UT.	2 (a)	11	6280	N-S	Gradual Curves	At Pass	Moderate	Severe
MULESHOE SUMMIT Lake & Muleshoe, NV.	3 (a)	8	6450	NE-SW	Gradual Curves	None	Moderate	Numerous
MURRY SUMMIT Statotee & White River, NV.	8 (a)	7	7320	NE-SW	More than Two Sharp Curves	Entire Route	Moderate to High	Numerous
NORTH TWIN PEAK Milford & Black Rock Desert, UT.	2 (a)	4	5250	NE-SW	Gradual Curves	None	Low	Severe
OAK SPRINGS SUMMIT Caliente & Dry Lake, NV.	6 (a)	17	6240	E-W	More than Two Sharp Curves	Entire Route	Moderate to High	Numerous
PAHROC SUMMIT Delamar & Pahroc, NV.	0.5 (a)	0.5	4960	E-W	Gradual Curves	None	Low	Severe
PATTERSON PASS Lake & Cave, NV.	8 (a)	3	7400	E-W	Gradual Curves	None	Moderate	Severe
PENOYER NORTHWEST Penoyer (Sand Spring) & Railroad, NV.	~3 (c)	8	5750	NE-NW	Gradual Curves	None	Low	Numerous
PINE PASS Snake & Pine, UT.	2 (b)	6	5880	N-S	Nearly Straight	None	Low	Severe

NOTES: (a) DATA ESTIMATED FROM 7½" (1:24,000) TOPOGRAPHIC MAP COVERAGE
 (b) DATA ESTIMATED FROM 15" (1:62,500) TOPOGRAPHIC MAP COVERAGE
 (c) DATA ESTIMATED FROM 2" (1:250,000) TOPOGRAPHIC MAP COVERAGE

(d) OVERALL EVALUATIONS

- I - EASY
 II - MODERATE
 III - DIFFICULT
 IV - VERY DIFFICULT
 V - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
 RANKING AND CATEGORIES, SEE SECTION 4.0

FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
	FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
Low	Several	None	Moderate	Moderate	I	U.S. 93. Utility line. Maximum slope on northeast side.
Moderate	Numerous	More than one	Difficult	Heavy	Y	Unpaved road. 230 k.v. line near center of pass on south side. North of road is IWIU UT-050-077.
Moderate	Numerous	One	Moderate to Difficult	Heavy	III	U.S. Hwy 6. Pass is in Toiyabe National Forest. Some private property in forest on alignment.
Moderate	Numerous	None	Difficult	Heavy	III	Unpaved road. Some private property at east end of alignment.
Low	Few	None	Easy	Light	I	Unpaved road from U.S. Hwy 6 to Tonopah Test Range.
Moderate	Several	One	Easy to Moderate	Light to Moderate	I	State Hwy 21
Moderate	Several	More than one	Easy to Moderate	Light to Moderate	II	Unpaved road. One quarter private property at southeast end of alignment and three quarters BLM at northwest end.
Moderate	Numerous	None	Moderate	Moderate	II	Unpaved road.
Moderate to High	Numerous	More than one	Difficult	Heavy	Y	U.S. Hwy 6. Hwy curves are too sharp for railroad. Along alignment east one quarter is BLM. Central to west is Humboldt National Forest.
Low	Several	None	Moderate	Light	I	Unpaved road.
Moderate to High	Numerous	More than one	Moderate to Difficult	Heavy	Y	U.S. Hwy 93. Private property on east access.
Low	Several	None	Easy	Light	I	U.S. Hwy 93. North of road is IWIU NV-050-0113. Alternate route is one mile north.
Moderate	Several	None	Difficult	Heavy	Y	Unpaved road. North of road is IWIU NV-040-169 (Grafton Scenic Area).
Low	Numerous	One	Moderate to Difficult	Moderate	II	Unpaved road. Alignment crosses bedrock pediment. Pass through IWIU NV-060-113.
Low	Several	None	Easy	Light	I	Unpaved road. South end, west side of alignment is Desert Range Experimental Farm. East side of road is IWIU UT-050-073.

(e) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL ALIGNMENT UNLESS OTHERWISE STATED

• BUREAU OF LAND MANAGEMENT (BLM) OWNERSHIP UNLESS OTHERWISE STATED

• ALL INITIAL WILDERNESS INVENTORY UNITS (IWIU) LISTED ARE APPROVED (AUG. 1978) FOR FURTHER FIELD STUDY AS POTENTIAL WILDERNESS AREAS BY BLM

RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS

TABLE
A-1
4 OF 7

FUGRO NATIONAL, INC.

12

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	DRAINAGE CROSS FREQUENCY
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								
<u>PINE WEST</u> Snake & Snake, UT.	4 (b)	5	6760	NE-SW	Gradual Curves	None	Moderate	Numerous
<u>QUEEN CITY SUMMIT</u> Penoyer (Sand Spring) & Railroad, NV.	~4 (c)	4	5950	NW-SE	Gradual Curves	Road	Low	Numerous
<u>RAILROAD PASS</u> Big Smoky & Stonewall Flat, NV.	4 (a)	18	6250	N-S	Two Sharp Curves	At Pass	Low to Moderate	Numerous
<u>RED ROCK SUMMIT</u> Railroad & Little Smoky, NV.	4 (b)	11	6650	NW-SE	Gradual Curves	None	Low	Numerous
<u>REVEILLE PEAK</u> Railroad & Reveille, NV.	4 (b)	~10	6160	NW-NE	Gradual Curves	Deep Wash	Low	Numerous
<u>RIEPELTOWN</u> Step toe (Ruth) & White River, NV.	4 (b)	3	7200	E-SW	More than Two Sharp Curves	Mine Dumps	Moderate	Numerous
<u>ROBINSON SUMMIT</u> Step toe (Ruth) & Jakes, NV.	4 (b)	10	7540	NW-SE	More than Two Sharp Curves	Entire Route	DNA	DNA
<u>SACRAMENTO PASS</u> Snake & Spring, NV.	4 (b)	10	7240	SE-NW	One or Two Sharp Curves	Narrow Pass	Moderate	Numerous
<u>SAND PASS</u> Fish Springs & Tule, UT.	4 (a)	1.2	4740	E-W	One or Two Sharp Curves	At Pass, Road	Low	Numerous
<u>SANDY SUMMIT</u> Big Sand Spring & Hot Creek, NV.	2 (b)	1	5920	E-SW	Gradual Curves	None	Low	Several
<u>SEAMAN WASH</u> Coal & White River, NV.	4 (a)	7	5070	NW-SE	More than Two Sharp Curves	Seaman Narrows	High	Numerous
<u>SHINGLE PASS</u> Cave & White River, NV.	4 (a)	11	6940	NE-SW	Gradual Curves	West End	Moderate	Numerous
<u>SIDEHILL PASS</u> Muleshoe & Cave, NV.	4 (a)	4	6130	E-W	Gradual Curves	None	Low	Few
<u>SILVER KING</u> Cave & White River, NV.	4 (a)	8	6330	E-NW	More than Two Sharp Curves	At Pass	Moderate	Numerous
<u>SKULL ROCK PASS</u> Whirlwind & Tule, UT.	4 (b)	3	5250	E-W	More than Two Sharp Curves	At Pass	Moderate	Numerous

NOTES: (a) DATA ESTIMATED FROM 7½' (1:24,000) TOPOGRAPHIC MAP COVERAGE

(b) DATA ESTIMATED FROM 15' (1:62,500) TOPOGRAPHIC MAP COVERAGE

(c) DATA ESTIMATED FROM 2" (1:250,000) TOPOGRAPHIC MAP COVERAGE

DNA-DATA NOT AVAILABLE

(d) OVERALL EVALUATIONS

I - EASY

II - MODERATE

III - DIFFICULT

IV - VERY DIFFICULT

V - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION RANKING
AND CATEGORIES, SEE SECTION 4.0

RANKING	FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
		FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
	Moderate	Numerous	More than one	Moderate	Moderate	II	Unpaved road.
	Low	Numerous	One	Moderate	Light to Moderate	II	State Hwy 25. Use sidehill route above wash. North of road is IWIU NV-050-113.
	Low to Moderate	Numerous	One or Two	Moderate to Difficult	Moderate to Heavy	III	Unpaved road southeast end of alignment only Numerous cross drainages along north end Alignment through IWIU NV-050-0336.
	Low	Numerous	More than one	Moderate	Light to Moderate	II	State Hwy 20(unpaved). South of road is IWIU NV-040- 153 Alternate west descent follows major drainage.
	Low	Numerous	One	Moderate	Moderate	II	Unpaved road in drainage. Major paleodrainage and rough terrain to cross North of road is IWIU NV-060-112.
	Moderate	Numerous	None	Moderate	Heavy	IV	Route through Kennecott Mine. Deep cuts through mine dumps. Access on tracks from Ely to Ruth Track has 800' tunnel on curve
	DNA	DNA	DNA	DNA	Very Heavy	IV	U.S. Hwy 50.
	Moderate	Numerous	More than one	Moderate to Difficult	Heavy	IV	U.S. Hwy 50 Small amount of private property near summit North of road is IWIU NV-040-086
	Low	Numerous	None	Moderate	Moderate	II	Unpaved road. North of road is IWIU UT-050-127
	Low	Several	None	Easy	Light	I	U.S. Hwy 6. Utility line. South of road is IWIU NV-060-162.
	High	Numerous	More than one	Moderate to Difficult	Moderate to Heavy	IV	Unpaved road. Best route from Pahroc Valley to Coal Valley. Road is between IWIU NV-040-246 & 247.
	Moderate	Numerous	One	Moderate	Moderate to Heavy	III	Unpaved road. Is in near proximity to IWIU NV-040-168 on the north and NV-040-172 on the south.
	Low	Few	None	Easy	Light to Moderate	I	Unpaved Road.
	Moderate	Numerous	None	Moderate	Moderate	II	Unpaved road. IWIU NV-040-217 in northwest area and NV-040-246 in the extreme south near the White River Sink/Burnt Peak interconnect Alternate pass one or two miles southeast.
	Moderate	Numerous	None	Moderate	Moderate to Heavy	III	U.S. Hwy 50. Transmission line. Recommended route two miles south of U.S. Hwy 50, 50 feet cuts and falls at summits (<1 mile). North of road is IWIU UT-050-078.

(e) ● HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL
ALIGNMENT UNLESS OTHERWISE STATED

● BUREAU OF LAND MANAGEMENT (BLM) OWNERSHIP UNLESS
OTHERWISE STATED

● ALL INITIAL WILDERNESS INVENTORY UNITS (IWIU) LISTED
ARE APPROVED (AUG., 1979) FOR FURTHER FIELD STUDY
AS POTENTIAL WILDERNESS AREAS BY BLM

RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSQ

TABLE
A-1
5 OF 7

FUGRO NATIONAL, INC.

1 2

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	DRI CRO FREQUENC
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								
<u>SMELTER KNOLLS</u> Tule & Snake, UT.	4 (b)	3	5690	NW-SE	Two Sharp Curves	At Pass	Moderate to High	Numerous
<u>SNAKE PASS</u> Tule & Snake, UT.	4 (b)	11	5980	NW-SE	Gradual Curves	At Pass	Moderate	Numerous
<u>STEAMBOAT PASS</u> Whirlwind & Tule, UT.	4 (b)	5	5250	E-W	Gradual Curves	None	Low	Several
<u>STONE CABIN</u> Stone Cabin East & Stone Cabin West, NV.	1 (c)	1.5	5700	E-W	Gradual Curves	None	Low	Several
<u>STONE CABIN NORTH</u> Stone Cabin East & Stone Cabin West, NV.	4 (a)	3	6225	NW-SE	Two Sharp Curves	At Pass	Low	Numerous
<u>THE TROUGHS</u> Hamlin & Spring, NV.	0 (a)	3	6050	E-W	Gradual Curves	None	Moderate	Numerous
<u>THE WALL</u> Railroad & Big Sand Springs, NV.	4 (a)	3	5850	NE-W	Gradual Curves	None	Low to Moderate	Few
<u>TIMBER MOUNTAIN PASS</u> White River & Coal, NV.	4 (a)	5	6080	E-W	Gradual Curves	None	Moderate	Numerous
<u>TONOPAH CENTRAL</u> Ralston & Big Smoky, NV.	3 (b)	6	5520	E-W	Gradual Curves	None	Low to Moderate	Numerous
<u>TONOPAH NORTH</u> Ralston & Big Smoky, NV.	4 (b)	4	6100	E-W	Gradual Curves	None	Low	Numerous
<u>TONOPAH SOUTH</u> Ralston & Big Smoky, NV.	3 (b)	6	5200	E-W	Gradual Curves	None	Low to Moderate	Numerous
<u>TOPAZ 1</u> Dugway & Fish Springs, UT.	4 (b)	1.5	5130	NE-SW	Gradual Curves	None	Low	Several
<u>TOPAZ 2</u> Dugway & Fish Springs, UT.	4 (b)	1	5380	E-W	One or Two Sharp Curves	At Pass, Road	Low	Several
<u>TOPAZ 3</u> Whirlwind & Fish Spring, UT.	4 (a)	10	5180	NW-SE	Gradual Curves	None	Moderate	Numerous
<u>TOPAZ 4</u> Dugway & Whirlwind, UT.	4 (a)	13	5960	N-SE	Gradual Curves	At Pass	Moderate	Numerous

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- I - EASY
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 □□ - DIFFICULT
 □□□ - VERY DIFFICULT
 X - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
 RANKING AND CATEGORIES, SEE SECTION 4.0

S	FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (C)	REMARKS (E)
		FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
	Moderate to High	Numerous	More than one	Moderate to Difficult	Heavy	IV	Unpaved road
	Moderate	Numerous	One	Moderate	Moderate	II	Unpaved road. At south end, north side of alignment is IWLU UT-050-070
	Low	Several	None	Moderate	Light to Moderate	I	Unpaved road. Open valley route five miles to the south
	Low	Several	One	Easy	Light to Moderate	I	Unpaved road. East half of alignment is BLM. West half is private property farm or ranch
	Low	Numerous	One	Easy	Moderate	I	Unpaved road. High in gravel east of pass. North of road is IWLU NV-050-06
	Moderate	Numerous	More than one	Easy to Moderate	Moderate	I	Unpaved road
	Low to Moderate	Few	One	Moderate to Difficult	Moderate	II	Unpaved road. Northern pass preferred route. Road is between IWLU NV-040-100 & 104
	Moderate	Numerous	One	Moderate	Moderate	II	Unpaved road. Road is between IWLU NV-040-141A & 140
	Low to Moderate	Numerous	None	Easy	Light to Moderate	I	Few resistant outcrops. Alternate to Tonopah South
	Low	Numerous	None	Easy	Moderate	II	Alternate to Tonopah South
	Low to Moderate	Numerous	None	Easy	Light to Moderate	I	
	Low	Several	None	Easy	Light to Moderate	I	Unpaved road
ad	Low	Several	None	Moderate	Light to Moderate	I	Paved road to Tonopah Mining Area. Unpaved roads
	Moderate	Numerous	None	Moderate	Moderate to Heavy	III	Jeep trail. Southwest of trail is IWLU UT-050-031. Tonopah 5 is a better route
	Moderate	Numerous	One	Moderate to Difficult	Heavy	IV	Unpaved road. Some resistant rock outcrops

(C) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL ALIGNMENT UNLESS OTHERWISE STATED

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RAILROAD PASS EVALUATION SUMMARY NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSQ

TABLE
A-1
OF

FUGRO NATIONAL, INC.

PASS NAME _____	ESTIMATED GRADE (MAXIMUM PERCENT)	LENGTH (MILES)	SUMMIT ELEVATION (FEET)	ORIENTATION	ALIGNMENT	CONSTRICTIONS	FLOOD POTENTIAL	DRA CRO FREQUENCY
BETWEEN _____ VALLEY AND _____ VALLEY, STATE								
TOPAZ 5 Fish Springs & Whirlwind, UT.	3 (a)	4	5000	N-S	Gradual Curves	Wash	Moderate	Numerous
WAH WAH SUMMIT Wah Wah & Pine, UT.	6 (b)	5	6440	E-W	One Sharp Curves	At Pass	Moderate to High	Numerous
WAH WAH WASH Wah Wah & Escalante, UT.	2 (b)	6	5600	N-S	Nearly Straight	None	Low	Several
WARM SPRINGS Reverie & Stone Cabin, NV.	3 (a)	5	6280	E-W	One Sharp Curve	At Pass, Road	Low to Moderate	Numerous
WARM SPRINGS NORTH Hot Creek & Stone Cabin, NV.	5 (a)	10	6940	SE-SW	More than Two Sharp Curves	Entire Route	High	Numerous
WATER GAP Coal & Garden, NV.	~1 (c)	3	5100	E-W	Gradual Curves	None	Moderate to High	Numerous
WELLS STATION SUMMIT White River & Railroad, NV.	4 (b)	15	6510	NW-SE	Gradual Curves	At NW End and at Pass	Moderate	Numerous
WHITE RIVER White River & Pahrnagat, NV.	2 (a)	16	4200	N-S	One or Two Sharp Curves	Road, Farms & Pass	Moderate	Numerous
WHITE RIVER SINK White River & White River, NV.	~1 (a)	9	5080	N-S	Gradual Curves	None	Low to Moderate	Numerous
WORTHINGTON PEAK Garden & Penoyer (Sand Spring), NV.	3 (c)	6	5950	NE-SW	Gradual Curves	None	Low	Numerous

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(d) OVERALL EVALUATIONS

- I EASY
- II MODERATE
- III - DIFFICULT
- IV VERY DIFFICULT
- V - AVOID IF POSSIBLE

FOR DESCRIPTION OF OVERALL EVALUATION
 RANKING AND CATEGORIES SEE SECTION 4 C

ID	FLOOD POTENTIAL	DRAINAGE CROSSINGS		EXCAVATIONS		OVERALL EVALUATIONS (d)	REMARKS (e)
		FREQUENCY	MAJOR STRUCTURES	DIFFICULTY	GRADING		
	Moderate	Numerous	One	Moderate	Moderate	II	.
	Moderate to High	Numerous	One	Moderate to Difficult	Moderate to Heavy	IV	State Hwy 21. Resistant rock. Some private property at eastern access. Road is between IWIU NV-040-204B & 205
	Low	Several	None	Easy	Light	I	Unpaved road. Use alignment on sidehill above wash. Potential site for Alumina mine and processing plant. KGRA (geothermal) in general area to southwest of alignment.
ad	Low to Moderate	Numerous	One	Moderate	Moderate	II	U.S. Hwy 8. Transmission line. Some private property & geothermal activity at east end of alignment. South of road is IWIU NV-050-150
te	High	Numerous	More than one	Difficult	Heavy	IV	Unpaved road. North of road is IWIU NV-050-050. Alternate to Warm Springs.
	Moderate to High	Numerous	One	Moderate	Light	I	Unpaved road. Private property in general area of access.
s	Moderate	Numerous	More than one	Moderate to Difficult	Moderate to Heavy	III	Unpaved road. Sidehill alignment. IWIU NV-040-159 to NV-050-133
	Moderate	Numerous	More than one	Moderate to Difficult	Moderate to Heavy	III	State Hwy 39. One quarter paved road in north, three quarters in south unpaved. One quarter states Key Pittman Wildlife Management Area in south. One half private property in center and one quarter BLM in north. Road divides IWIU NV-040-247, 250 & NV-050-0113
	Low to Moderate	Numerous	One	Easy	Light	I	Unpaved road. Route along terrace above river bottom. Three quarters private property in north. One quarter BLM in south. Alignment not in IWIU area, not runs between NV-040-247 & NV-040-247A
	Low	Numerous	One	Moderate	Light	I	Unpaved road. Road between IWIU NV-040-235 & 240

(f) • HIGHWAY (HWY) AND UTILITY LINES GENERALLY PARALLEL ALIGNMENT UNLESS OTHERWISE STATED

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RAILROAD PASS EVALUATION SUMMARY NEVADA UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS

TAB 1
A-1
34

FUGRO NATIONAL, INC.

12

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-8